STUDY OF PREVALENCE OF URINARY TRACT INFECTION IN FEBRILE CHILDREN LESS THAN 5 YEARS OF AGE

Dissertation submitted in partial fulfilment of the

Requirement for the award of the Degree of

M.D. DEGREE – BRANCH VII

PAEDIATRICS

APRIL 2016

TIRUNELVELI MEDICAL COLLEGE HOSPITAL

THE TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY,

CHENNAI,

TAMIL NADU

CERTIFICATE

This is to certify that the Dissertation entitled "**STUDY OF PREVALENCE OF URINARY TRACT INFECTION IN FEBRILE CHILDREN LESS THAN 5 YEARS OF AGE**" submitted by Dr.K.Visalakshi, MBBS, to The Tamilnadu Dr.M.G.R. Medical University, Chennai, in partial fulfilment for the award of M.D (Paediatrics) is a bonafide work carried out by her under my guidance and supervision during the academic year 2013-2016. This dissertation partially or fully has not been submitted for any other degree or diploma of this university or other.

GUIDE
Dr.A.S.Babu Kandakumar,
MD.,DCH.,DNB,MNAMS.
Department Paediatrics,
Tirunelveli Medical College,
Tirunelveli- 627011.

HOD
Prof.Dr.C.Krishnamurthy,MD.,
(Paediatrics).,
Department Paediatrics,
Tirunelveli Medical College,
Tirunelveli- 627011.

Dr K.Sithy Athiya Munavarah, DCH., MD(PATHO)
THE DEAN,
Tirrunelveli Medical College,
Tirunelveli- 627011.

DECLARATION

I, Dr.K.Visalakshi, MBBS, solemnly declare that the Dissertation titled **"STUDY OF PREVALENCE OF URINARY TRACT INFECTION IN FEBRILE CHILDREN LESS THAN 5 YEARS OF AGE"** had been prepared by me under the expert guidance and supervision of **.Dr.A.S.Babu Kandakumar, MD.,DCH.,** Professor, Department of Paediatrics, Tirunelveli Medical College Hospital, Tirunelveli.

The dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the regulation for the award of M.D. Degree (Branch VII) in Paediatrics.

It was not submitted to the award of any degree/diploma to any University either in part or in full previously.

Place: Tirunelveli.
Date:

Dr.K.Visalakshi, MBBS.,
POST GRADUATE,
M.D. (Paediatrics),
Tirunelveli Medical College,
Tirunelveli.

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CONTENTS

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91-462-2572733-EXT; 91-462-2572944; 91-462-2579785; 91-462-2572611-16
online@tvmc.ac.in, tirec@tvmc.ac.in; www.tvmc.ac.in

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NAME OF PRINCIPAL INVESTIGATOR: Dr. K. Visalakshi, MBBS.,
DESIGNATION OF PRINCIPAL INVESTIGATOR: Post Graduate in MD Paediatrics
DEPARTMENT & INSTITUTION: Department of Paediatrics, Tirunelveli Medical College

Dear Dr. K. Visalakshi, *The Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during the IEC meeting held on 14.05.14.*

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1.	TIREC Application Form	☐
2.	Study Protocol	☐
3.	Department Research Committee Approval	☐
4.	Patient Information Document and Consent Form in English and Vernacular Language	☐
5.	Investigator's Brochure	☐
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13.	Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA)	☐
14.	Clinical Trials Registry-India (CTRI) Registration	☐

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1. The approval is valid for a period of 2 year/s or duration of project whichever is later
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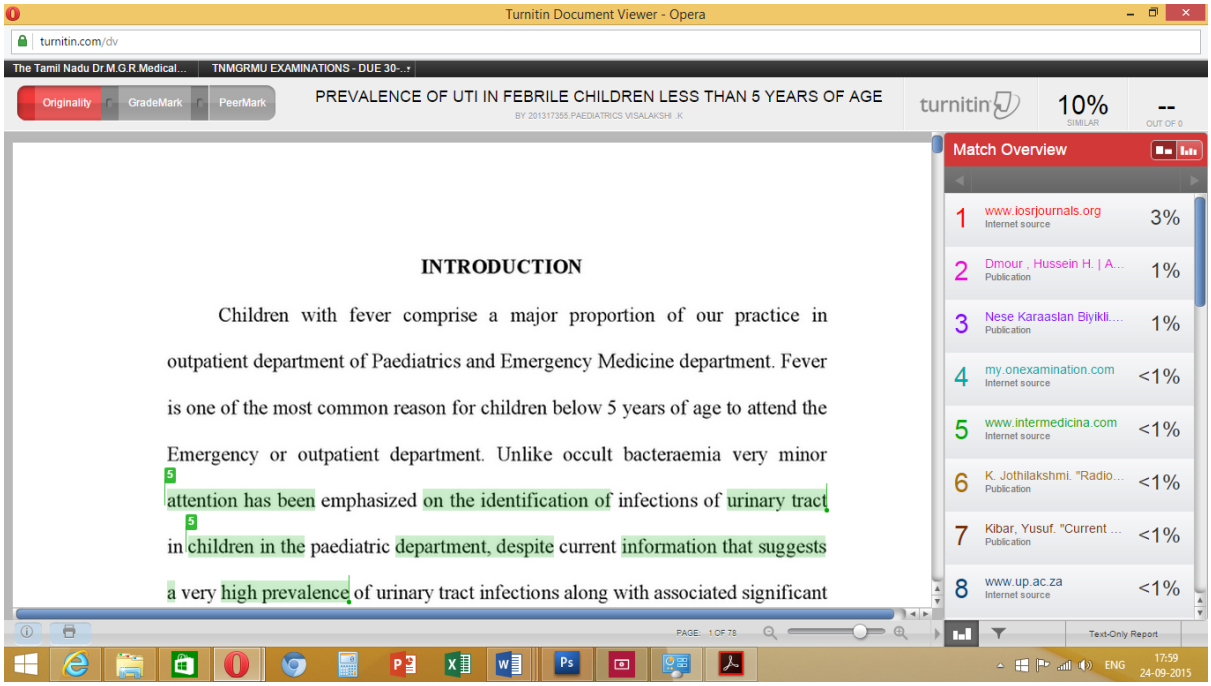
Dr.K.Shantaraman MD
Registrar, TIREC
Tirunelveli Medical College, Tirunelveli – 627011
State of Tamilnadu, South India

Dr.V.Ramasubramanian MD DM
Member Secretary, TIREC
Tirunelveli Medical College, Tirunelveli – 627011
State of Tamilnadu, South India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INTRODUCTION
Children with fever comprise a major proportion of our practice in outpatient department of Paediatrics and Emergency Medicine department. Fever is one of the most common reason for children below 5 years of age to attend the Emergency or outpatient department. Unlike occult bacteraemia very minor attention has been emphasized on the identification of infections of urinary tract in children in the paediatric department, despite current information that suggests a very high prevalence of urinary tract infections along with associated significant
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ABBREVATIONS

UTI	-	urinary tract infection
MCU	-	micturating cystouretherogram
CFU	-	colony forming units
HPF	-	high power field
URI	-	upper respiratory infection
PUJ	-	pelviureteric junction
PE	-	pleural effusion
VUR	-	vesicoureteric reflux
SES	-	socioeconomic status
PUV	-	posterior urethral valve
DMSA	-	dimercaptosuccinic acid
ESBL	-	extended spectrum beta lactamases
Rpm	-	rotation per minute
USG	-	ultrasonogram

ABSTRACT

Fever is the most common reason for children under 5 years of age to visit the OPD. Unlike other foci of infection only little attention has been focused on identification of UTI in febrile children. Quite often child receives antibiotics empirically without adequate evaluation of UTI.

Hence it is essential to identify UTI in febrile children to institute prompt treatment & to reduce the threat of lifelong morbidity.

AIMS & OBJECTIVES-

1)To determine the prevalence of UTI in all febrile children, from 2 months to 5years of age.

2)To determine the validity of urinary tests in the diagnosis of urinary tract infection

DESIGN- hospital based prospective study

METHODS & MATERIALS-

Study includes 200 consecutive children from 2 month to 5 years admitted in the paediatric department of Tirunelveli medical college with febrile illness.

- Data related to age, sex, predisposing factors will be noted.
- Urine analysis and urine culture has to be done in all these patients.
- USG abdomen to be done in patients with culture positive UTI

COLLECTION OF URINE SAMPLE-

Clean midstream catch in children more than 2 years

Bag collection in children less than 2 years

INCLUSION CRITERIA-

Febrile children between 2 month & 5 yrs

Fever of axillary temperature > 37.8`c

EXCLUSION CRITERIA-

Children less than 2 month & more than 5 years

Any child who has received antibiotics 48 hours prior to admission.

Children with known congenital genitourinary anomalies

CONCLUSION-

Our present study reveals the overall prevalence rate of UTI as 9.5%.

The prevalence rate in children <1 year of age was highest (4%).

All the children with pyuria of > 5 pus cells/ HPF of centrifuged urine sample were found to have significant growth and hence the association between pyuria >5 pus cells and urine culture is highly significant and hence this test is highly valid.

KEY WORDS-UTI, prevalence, pyuria, significant growth

INTRODUCTION

Children with fever comprise a major proportion of our practice in outpatient department of Paediatrics and Emergency Medicine department. Fever is one of the most common reason for children below 5 years of age to attend the Emergency or outpatient department. Unlike occult bacteraemia very minor attention has been emphasized on the identification of infections of urinary tract in children in the paediatric department, despite current information that suggests a very high prevalence of urinary tract infections along with associated significant morbidity in these children. Very often, child receives antibiotics empirically, without any adequate evaluation for urinary tract infection. Fever many times is often the only symptom in children with urinary tract infections.

Fever along with significant bacteriuria, pyuria in children with undocumented sources of infections must be presumed to be symptoms of pyelonephritis, an invasive infection of the renal parenchyma requiring prompt treatment.

Recent studies using renal parenchyma - avid nuclear scans to determine urinary tract infection has revealed that more than 80% of children less than 5 years of age with febrile urinary tract infection have pyelonephritis[1, 2, 3] .

Pyelonephritis usually leads to renal scarring in 30% to 65% of children with urinary tract infections in this age group, even in the absence of underlying urinary tract abnormalities[4, 5]. Most urinary tract infections that lead to scarring or diminished kidney growth occur in children younger than 4 years of age especially among infants in the first year of life[2, 5] those with gross reflux or obstruction and those who have a delay in therapy for urinary tract infection. Among children

under 2 years of age with recurrent urinary infections, putting them at higher risk for renal scarring, as many as one-third being asymptomatic[6].

It is essential to identify infections of the urinary tract in children and institute prompt treatment in order to reduce the potential for life long morbidity. Progressive renal damage from unrecognised pyelonephritis in childhood may lead to hypertension and chronic renal failure in later life.

A study conducted in Sweden had showed that focal renal scarring caused by pyelonephritis in children carried a 25% risk for hypertension a 10% risk for renal failure, and a 15% risk for toxemia during pregnancy as an adult[7]. Approximately 13% of renal failure is thought to be related to urinary tract infection in children that was often unrecognised and therefore, under treated[8].

The present study is undertaken to estimate the overall prevalence of infections of urinary tract in children with fever from 2 months to 5 years of age and to also to assess the validity of urinary tests like urine analysis and urine culture for the diagnosis of Urinary Tract infection.

AIMS AND OBJECTIVES

1. To determine the prevalence of urinary tract infection in all febrile children, from 2 months to 5years of age.

2. To determine the validity of urinary tests (urine analysis and urine culture) in the diagnosis of urinary tract infection.

REVIEW OF LITERATURE

DEFINITION

Urinary tract infection can be defined as the infection present in any part of the urinary system that includes the kidneys, ureter, bladder and urethra. It is the growth of a significant number of microorganisms within the urinary tract. In general the lower urinary tract is more affected than the upper urinary tract.

The upper urinary tract infection affects the kidneys and the lower tract infection involves the bladder, prostate and urethra.

Significant bacteriuria can be termed when there is a growth of more than 10^5 colonies/ml of urine showing single species of microorganism collected through clean midstream urine.

EPIDEMIOLOGY

The incidence of infection of the urinary varies based on the age, sex and gender of children. An estimate shows an annual affection of 2.4 – 2.9% children in the country. In the first year of life, the incidence is higher in boys than in girls, and then there is a marked decease after that.

The average prevalence rate of urinary tract infection in infants according to the study by Shaikh et al presenting with fever was 7.0%. In boys the incidence is higher in uncircumcised ones with a percentage of 20.1 compared to circumcised boys with a percent of 2.4. The study further shows

that in children the risk of scarring is almost doubled in those who have an abnormal ultrasound finding, with a fever of above 39 C (102 F), or an infection with an organism other than Escherichia coli.

PREVALENCE

(Roberts K. et al[9] 1983) had studied about 193 febrile children less than 2 years of age and reported the prevalence rate of urinary tract infection as 4.1%. The prevalence of urinary tract infection in febrile girls was higher (7.4%).

(Bauchner et al[10)] in 1987 had evaluated the frequency of urinary tract infection in 664 febrile children younger than 5 years of age and had reported a prevalence rate of only 1.7%

According to (Hoberman et al[11] 1993) the prevalence rate of urinary tract infection in febrile infants was found to be 5.3% and the prevalence in infants less than 2 months was 4.6% and among infants with no suspected urinary tract infection, with associated other illnesses the prevalence rate of urinary tract infection was 5.1%.

(Dharnidharka et. al[12]1993) had reported the overall prevalence rate of Urinary Tract Infection to be 5.4% in febrile infants.

According to (P.R. Srivaths et. al[13] 1996) the prevalence rate of Urinary Tract Infection in children less than 2 years was 2.48% which was the lowest reported from a developing country and it is similar to the prevalence rates reported from developed countries.

(Shaw KN and Gorelick MH [1] in 1999) reported the prevalence rates of urinary tract infection in febrile infants in the emergency department as

approximately 3-5% with higher rates for white girls, uncircumcised boys, and those without any another potential source of fever.

(M.H. Fallahzadeh et al[14] 1999) estimated the prevalence rate of urinary tract infections in preschool children and had reported a prevalence of 4.4%.

About 5% of girls and only 1% of boys acquire a urinary tract infection. In girls, the average age at the first diagnosis of UTI is 3 years, which coincides with the onset of toilet training. In boys most of the urinary tract infections occur in the first year of life. The prevalence of urinary tract infection varies with age of the child. During 1st year the incidence is higher among boys.Beyond 1-2 years, there is a striking female preponderance.

Lin DS[16] in 2000 had reported a prevalence rate of urinary tract infection as 13.6% in febrile infants younger than 8 weeks age.

Andrew Dziewit J [17] in 2002 had studied febrile infants less than 8 weeks and had reported a prevalence of urinary tract infection as 4.2%.

ETIOLOGY

According to (Sobel et al[18] 1991) urinary tract infections might occasionally be caused by viruses and fungi, but the overwhelming majority of urinary tract infections are caused by bacteria.

There are various factors that determine the level and severity of infection, some among which are the size of the inoculum of the microorganism, host resistance and virulence of the infecting strains.

Most of the infections are caused by facultative anaerobes that originate from the flora of the bowel. There are other pathogens that originate in the flora of the perineal skin or vagina.

BACTERIOLOGY OF UTI:

(Byran CS et al[19] 1984) had reported that Escherichia coli was the most common urinary pathogen accounting for 85% of community acquired urinary tract infection.

According to (Arvind Bagga et al[20] 2000) about 90% of first symptomatic urinary tract infection and 70% of recurrent infections were due to Escherichia coli. Less commonly, other enteric gram negative bacteria such as proteus or Klebsiella and Staphylococcus saprophyticus are responsible for community - acquired infections.

The distribution of urinary pathogens in hospitalized patients is different, with E.coli accounting for about 50% of infections, and Klebsiella, Enterobacter, Citrobacter, Serratia, Pseudomonas aeruginosa, Providencia, Enterococcus and S.epidermidis accounting for most of the rest[21] Fungal infections occur almost exclusively in hospitalized patients.

According to Sobel et al[18] (1991) indwelling catheters, cross infection, instrumentation of urinary tract, and selection of a resistant bowel and environmental flora by antimicrobial therapeutic agents contribute to altered microbiology of nosocomial urinary tract infections. The risk for acquiring nosocomial urinary tract infection due to E.Coli and proteus species generally decreases as the length of hospitalization increases, and urinary tract infections are more likely to be caused by Serratia and Pseudomonas aeruginosa as hospitalization progress.

VIRULENCE-

According to(Zafriri D, Gron Y. et. al[23] 1987) adherent bacteria not only persist within the urinary tract but also have growth advantages and enhanced toxicity as a result of proximity to products restricted in their diffusion that are secreted by eukaryotic cells. This could have resulted in more effective delivery of toxins to the cells.

(Varian S. et. al[24] 1980) observed the relationship between *in vitro* adherence of E.Coli and severity of urinary tract infection *in vivo*.

Bacteria with P fimbriae are more likely to cause pyelonephritis. Between 78 and 95% of pyelonephritogenic strains of Escherichia coli have P fimbriae, compared with 23% of Cystitis strains[15].

According to (Thulesius O. et al[25] 1987) lipopolysaccharide also acts to reduce ureteric peristalsis, hence facilitating the ascent of Escherichia coli via the relatively dilated, hypotonic ureters to the kidneys.

(Leying et.al[26] 1990) reported that capsular K_1 expression is a prerequisite for serum resistance and loss of ability to synthesize K_1 leads to loss of serum resistance.

According to (Hughes C. et. al[27] 1983) hemolysins are thought to contribute to spread of Escherichia coli within renal parenchyma.

(Stuart SJ et al[28] 1980) had identified the two mechanisms of iron uptake in Escherichia coli, the hydroxymate type of siderophore- aerobactin and the catechol type of siderophore- enterochelin.

According to (Hovelius B, Mardh PA et. al[29] 1984) staphlococcus saprophyticus has a predilection for causing urinary tract infection by virtue of its avid adherence to uroepthielial cells.

Bacteria:

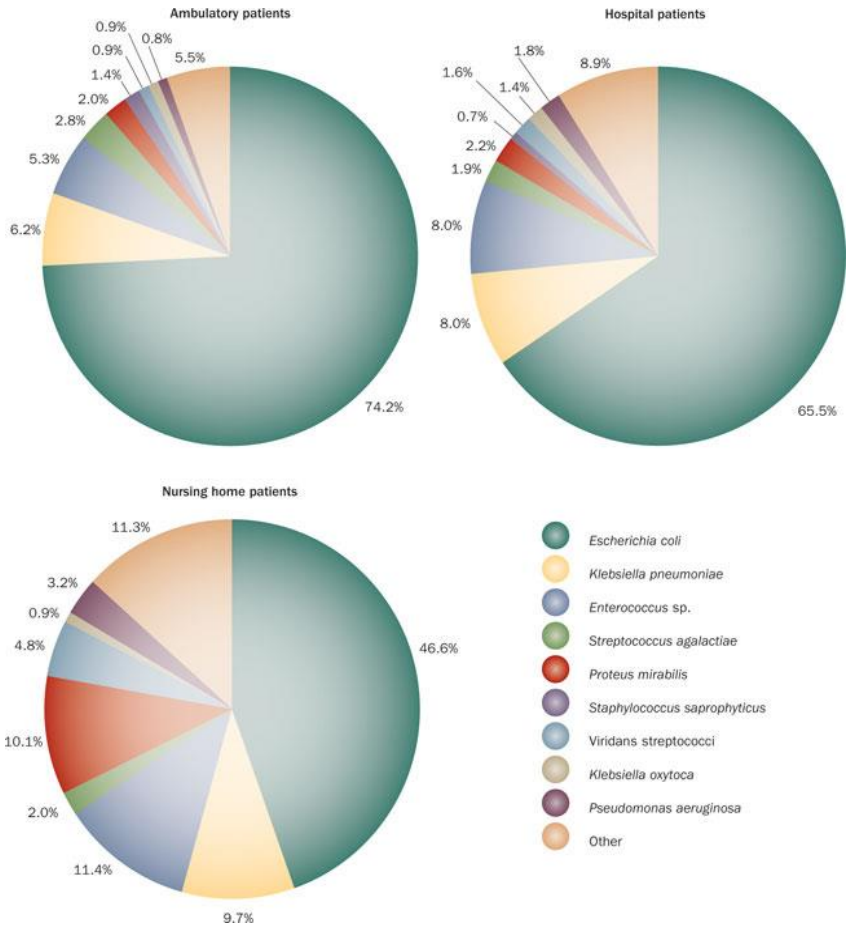
- Escheriachia coli (most common, 75-90% of UTIs)
- Klebsiella species
- Enteococcuc species
- Staphylococcus saprophyticus
- Streptococcus group B
- And Pseudomonas aeruginosa

Fungi :

- Most common are the Candida species, usually after instrumentation of the urinary tract.

Virus :

- A very rare cause is the Adenovirus which causes hemorrhagic cystitis.



GENETIC FACTORS

It is also stated that deregulation of several genes may predispose an individual to the occurrence of recurrent UTIs. Hence identification of such genes may be very helpful in the identification of at risk individuals, and therefore help in the prediction of recurrent UTIs in their offsprings[30]. Genes that responsible for susceptibility to recurrent UTIs: CXCR1, CXCR2, TLR2, TLR4, TGFβ1.

NON INFECTIOUS- NON BACTERIAL CYSTITIS:

This is a catchall term that includes many medical conditions which includes both infectious and non-infectious cystitis. There are various causes a few among which are listed below.

Infectious nonbacterial cystitis includes

- Viral
- Mycobacterial
- Chlamydia
- Fungal
- Schistosomal

Non infectiousnon bacterial cystitis includes

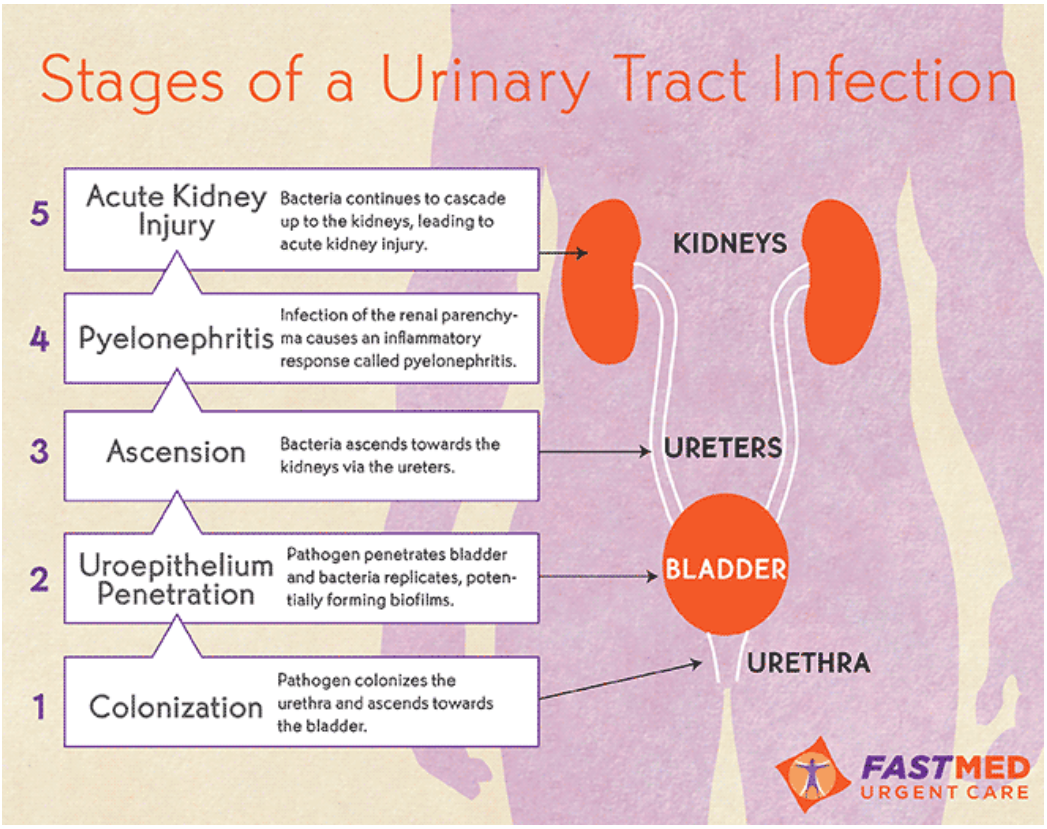
- Radiation induced
- Hypersensitivity
- Chemical
- Autoimmune

PATHOPHYSIOLOGY

Generally UTI develops when the uropathogens that colonised the periurethral region ascend along the urethra to the urinary bladder. The

pathogens usually spread up the urinary tract to the kidneys, where it is called pyelonephritis, and rarely to the blood stream, where it is called bacteremia[31].

The urine within the proximal part of urethra and bladder is usually sterile. Contamination of bacteria in the bladder can be due turbulent flow of urine during normal voiding conditions or with voiding dysfunction or instrumentation. Sexual intercourse and manipulation of the genitals might also be a cause for entry of bacteria into the bladder. Other rare routes of infection may be the fecal-perineal-urethal one or during bacteremia in septicaemia.



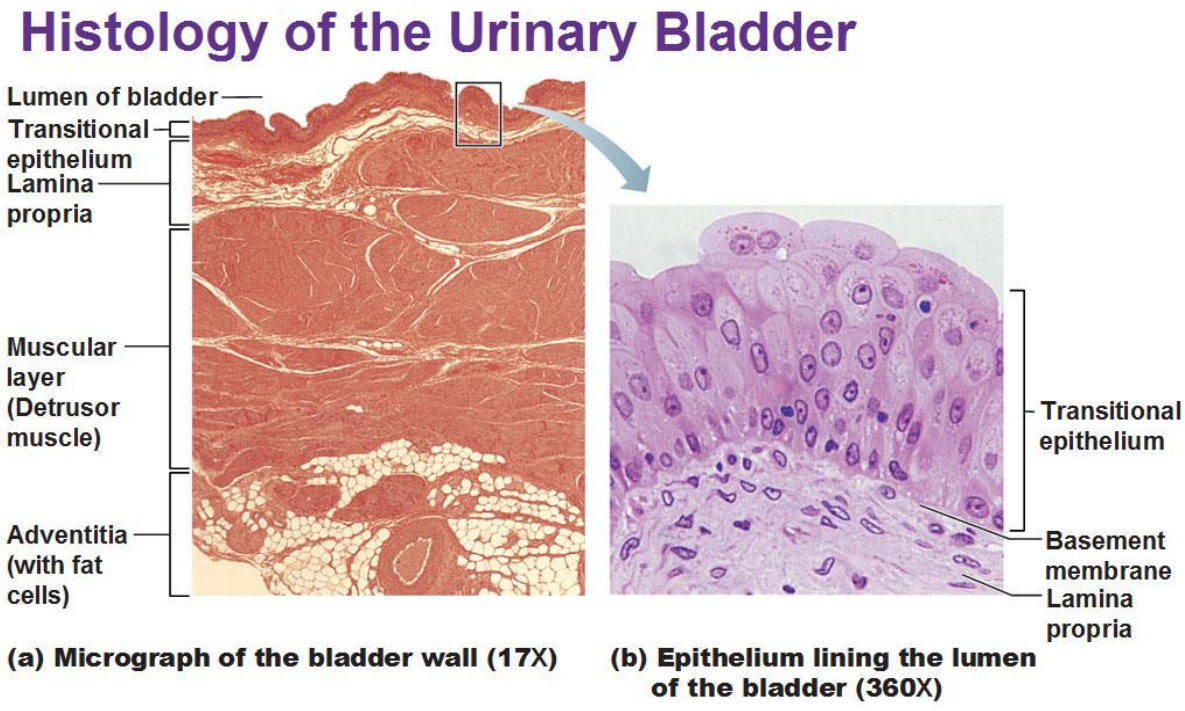
HISTOLOGY OF THE URINARY TRACT

URINARY BLADDER:

- The bladder is lined with three layers of smooth muscle, and also a lining of transtitional epithelium. It is difficult to differentiate between the three layers, since the bladder is sac like structure and not a tube.

- The mucosa of the bladder is very heavily folded as this helps in the accommodation for very large volume changes.

- The transtitional epithelium lining the bladder can stretch until it looks like a stratified squamous epithelium.

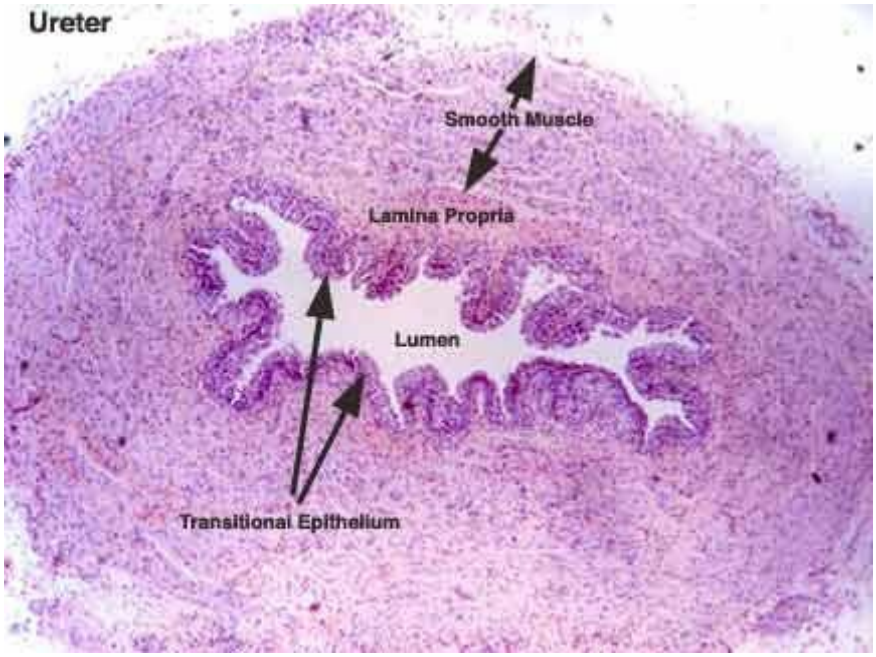


URETER:

- Inner layer- Mucosa: It consists of a layer of tansititional epithelium which is avascular. It also contains the lamina propria which is composed of areolar connective tissue, blood vessels and nerves. Since there is no muscularis mucosa, the lamina propria and submucosa tend to merge[25].

- Middle layer – Muscularis: It consists of smooth muscle whose main function is to propel the urine. There is a inner longitudinal layer, middle circular and outer longitudinal layer of the smooth muscle.

- Outer layer – Adventitia/Serosa: It is a supporting layer of fibrous connective tissue. It contains adipose tissue.



VIRULENCE FACTORS OF PATHOGENS

Virulence means the ability of the microorganisms to cause a disease in an individual, as assessed by the clinical severity of the infection, complications and the anatomic level. In a compromised natural defense mechanism in an individual, it takes fewer virulence requirements by the bacterial strain to induce infection within the urinary tract.

Virulence factors associated with E. coli UTI isolates:

1. Expression of certain O: K: H serotypes
2. K polysaccharide capsule
3. Adherence to uroepithelial cells
4. Resistance to serum bactericidal activity
5. Hemolysin production
6. Aerobactin production
7. Other possible factors
    - Bacterial generation time in urine
    - Bacterial ureteroplegic factor
    - Colicin V production
    - Salicin fermentation

Adherence to the uroepithelial cells by the bacteria is a prerequisite for the colonisation and persistence of infection in a system where there is continuous flow of urine. Pathogens must bind to the epithelium to cause infection[22].

The bacteria that are adherent not only persist within the urinary tract, but also have enhanced toxicity and growth advantages as a result of proximity to the products restricted in their diffusion secreted by the eukaryotic cells. This ultimately results in more effective delivery of toxins to the cells.

There is a proportional relationship between the in vitro adherence of E. coli and the in vivo severity of the urinary tract infection. Those with the P fimbriae are more likely to cause pyelonephritis. Similarly the capsular K1 expression is a prerequisite for the development of serum resistance.

It is also stated in many studies that the lipopolysaccharide also acts in reducing the ureteric peristalsis, hence further facilitating the ascent of the bacteria via the relatively hypotonic and dilated ureter to the kidneys.

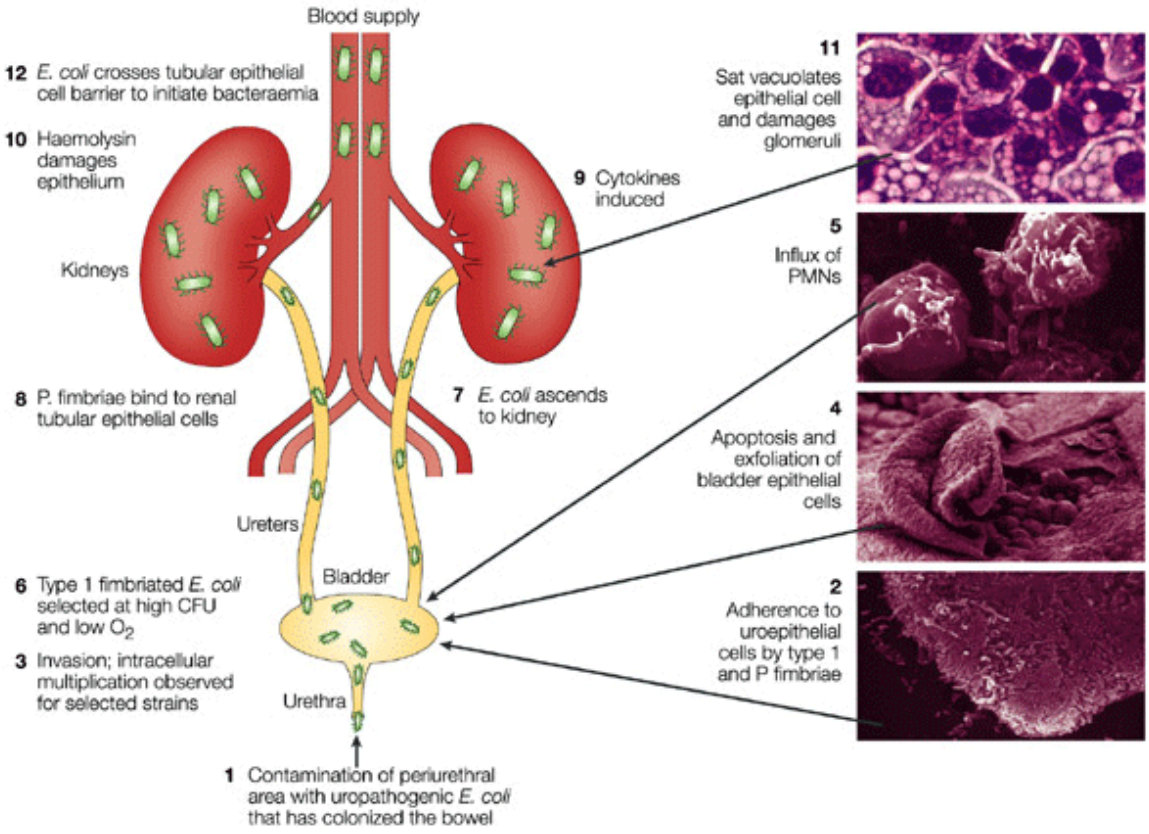
The spread of the infection within the renal parenchyma is contributed by the Hemolysins. There are two identified mechanisms of uptake of iron within the bacteria, the aerobactin, the hydroxymate type of siderophore and enterochelin, the catechol type ofsiderophore.

Virulence factors associated with Non E. coli UTI isolates:

Staphylococcus saprophyticus, an uropathogen that is common in young women and sexually active women predominantly causes cystitis. These bacteria have a predilection for causing infection by virtue of its adherence to the cells of the urinary tract[32].

Other bacteria like the Enterobacteriaceae, including the Klebsiella, Proteus species and the Providenciastuartii have been known to use the fimbriae for adherence to the uroepithelium and urinary catheters.

Staphylococcus epidermidis rarely causes infection in non-catheterised patients and is a common cause of infection in catheteised patients by virtue of the capacity of the bacteria to attach to and form a biofilm on foreign bodies like catheters.



HOST DEFENSES IN THE URINARY TRACT

1. Anatomic factors
2. Urine
3. Immune response
4. Anti-adherence mechanism

ANATOMIC FACTORS:

- **Vaginal Introitus:**

The mucosa of the vagina is normally colonised by lactobacillus, despite the close proximity and the frequent contamination with enteric organisms. However, at risk women have been seen to have enteric organisms colonising the surface of the mucosa of the vaginal introitus[33]. This has been attributed to the increased receptivity of the uroepithelial and vaginal cells for the attachment of the E. coli organism in these patients. It is stated that perhaps this increased receptivity is controlled by certain genetic factors. Certain blood group substances that are seen to appear on the surface of the uroepithelial cells may function either as receptors for the attachment of bacterial surface structures or block the attachment to less prominent receptors.

- **Bladder:**

The mechanical removal of microorganisms from the bladder by dilution with fresh urine, followed by the complete emptying of the urinary bladder, helps in removing bulk of the contaminated urine. However micturition leaves behind a complete film of contaminated urine on the surface of the mucosa of the bladder which is sufficient to maintain colonisation[25]. Despite this there are various studies that demonstrate the effectiveness of the antibacterial property of the bladder mucosa in containing surface contamination. The major contributor to this is the surface mucin coating of

the bladder mucosa that plays a role in preventing the attachment of the bladder and subsequent colonisation.

- **Ureter:**

Ureteral peristalsis helps in the flow of urine from the kidney into the bladder. Diminished peristalsis of the ureter contributes to increased susceptibility to infection especially during pregnancy. This diminished peristalsis is controlled by a heat sensitive calcium ionophore present in some uropathogens[33].

A competent vesicoureteral valve determines the efficacy of bladder emptying, which helps in preventing contaminated bladder urine from going up the ureters during voiding, thereby allowing only fesh urine into the bladder when the voiding is complete. However even in normal conditions, microorganisms can sometimes ascend against the flow of urine, vesicoureteric reflux being the gross passage of urine from the bladder into the ureters on voiding. This reflux impairs the efficiency of the emptying of the bladder by producing residual urine within the ureter. Vesicoureteric reflux occurs in children as a congenital developmental anomaly. In case the reflux is severe in children, it may exert a significant hydrostatic pressure on the renal pelvis and this impairs the growth of the kidneys even in the presence of sterile urine. However in the presence of infected urine, the damage to the kidneys is rapid.

Conditions that cause extrarenal obstruction to the ureters such as calculi, congenital urinary tract abnormalities or tumours can cause an harmful increase in the hydrostatic pressure on the kidneys and hamper the efficient emptying of the outflow tract. Although obstruction per se does not increase the contamination of urine with organisms, it however increases the risk of renal infection.

- **Kidney:**

The renal cortex is more resistant to the development of infection than the medulla, for both gram positive cocci and gram negative bacilli reaching the kidney by either the ascending or hematogenous route[30]. There are various factors that impede the cellular and humoral defences within the renal medulla such as the high concentration of ammonia, high osmolality, the relatively low blood flow and the relative anoxic state.

URINE:

The urine is inhibitory and sometimes even bactericidal against a small size inoculum of uropathogens. The most common inhibitory factors in urine are as follows,

- High osmolality
- Concentration of urea and other organic acids
- Low pH oligosaccharides
- Uromucoid (Tamm Horsfall protein)

- Antibody produced during immune response

The uromucoid protein prevents the adherence of the pathogens by aggregating them in the urine. These factors play a major role in inhibiting the colonisation and growth of the bacteria within the body.

Modification in the composition of the urine that is seen in many medical conditions or as an effect of drugs, can alter the ability of the urine to support the growth of pathogens. One such example is a high glucose level in the urine of diabetics enhances the growth of organisms such as E. coli and Candida albicans. When the pH of the urine reaches to around 5, there is conversion of the weak organic acids to the unionised form which has antibacterial activity[34].

Changes in the urinary composition may also have an opposite effect on the host defense mechanisms in other areas of the urinary tract. An example of this is that acidification of the urine stimulates the renal production of ammonia, which in turn activates the complement factor, that is an important factor for phagocytosis within the tissues. Thus it is seen that acidification which enhances urinary defences on one hand, diminishes the renal defences simultaneously.

Water diuresis plays a major role in enhancing urinary defences by many mechanisms given below,

- It increases the medullary blood flow, which enhances the delivery of phagocytic cells and other antibacterial substances to the renal tissues.

- The normally high osmolality of the medulla which interferes with the activity of the complement and also migration of the phagocytes into the parenchyma of the kidney is abolished by water diuresis.

- It boosts the bladder defence mechanisms by increasing the emptying of the bladder.

IMMUNE RESPONSE:

The immune response to the presence of infection has a limited role in both renal and bladder infection[35]. In renal infections, both local and systemic antibody production is seen, with type specific antibody detectable in sample of urine, way before the antibody titre can be detected in the serum. The antibody present in the urine functions by decreasing the adherence of the bacteria to the uroepithelial cells.

ANTI – ADHERENCE MECHANISM:

The urinary tract has various anti adherence mechanisms, that may be specific or nonspecific, interfering with colonisation of all organisms.

- The normal flora found in the vaginal introitus, periurethral region and also the urethra cause stearic hindrance and make the receptors less available.

- The uromucoid or urinary slime, usually the Tamm-Horsfall protein, is very rich in mannose residues and avidly binds E.coli thereby preventing the attachment to the uroepithelial cells.

- Immunoglobulins such as IgG, IgA found in the urine of patients presenting with pyelonephritis have inhibited adherence of the strain of E, coli to the uroepithelial cells[36].

- Urine normally contains various oligosaccharides including manno ones that inhibit the attachment of the type 1 fimbria.

- The layer of mucopolysaccharides that line the transitional cells of the mucosa of the bladder interferes with the adhesion of the microorganisms.

- The mechanical effect produced by flushing during bladder emptying is very essential in preventing adherence.

RISK FACTORS FOR URINARY TRACT INFECTIONS[5]

1. Uncircumcised male
2. Vesicoureteric reflex
3. Toilet training
4. Obstructive uropathy
    - Congenital anomalies
    - Renal calculi
    - Ureteral obstruction (total or partial)
5. Tight clothing – underwear
6. Instrumentation in the urinary system

- Indwelling foleys catheter
- Catheterisation
- Cystoscopy
- Dilatation of urethra

7. Constipation
8. Residual urine within the bladder
    - Neurogenic bladder
    - stricture in urethra
    - hypertrophy of prostate
9. Alteration in periurethral flora by antibiotics
10. Sex -women
    - Honeymoon cystitis
    - Pyelitis of pregnancy
    - Use of spermicide or diaphragm
11. Diabetes mellitus
12. Immunosuppression especially in post-transplant

ROUTES OF INFECTION

1. Ascending route
2. Hematogenous
3. Lymphatic

ASCENDING ROUTE:

The most common route for urinary tract infection is the ascent of pathogens within the urethra from external sources, especially organisms of enteric origin, which includes Escherichia coli and other Enterobacteriaceae. The urethra is shorter in females compared to males and this is the reason for easier contamination with colonic flora that reside on the perineal skin. The greater length of the urethra and the antibacterial property of the prostatic secretions are effective barriers to invasion by the this route in males[37].

In ambulatory patients, a single insertion of urinary catheter results in urinary tract infection in around 1-2% of them. However, indwelling catheters with an open drainage system result in urinary tract infections in almost 100% of the cases within a period of 3-4 days. The delay in the onset of infection in closed drainage system is in itself a strong evidence for the ascending route of infection in patients with catheters.

Microorganisms further ascend from the bladder into the ureter, against the flow of urine, especially facilitated by the vesicoureteric reflux, and on

reaching the pelvis they may penetrate the kidney via the lymphatics or via backflow into the collecting system of the kidneys.

HEMATOGENOUS ROUTE:

This route of infection is relatively rare, and is restricted in few uropathogens that include Staphylococcus aureus, Candida species, Mycobacteium tuberculosis and Salmonella, which are causative organisms for primary infection elsewhere in the body[38].

LYMPHATIC ROUTE:

The spread of infection to the urinary tract via the lymphatics still remains speculative.

SYMPTOMS & SIGN IN UTI

Clinical course of a UTI varies with the age of the child.. However there are no specific signs or symptoms that are used to identify in children[9].

Children aged 0-2 mths	Failure to thrive Fever Poor feeding Vomiting Hypo/hyperthermia Jaundice

	Irritability
Infants and children aged 2 mths – 2yrs	Poor feeding Fever Vomiting Malodorous urine Irritability Abdominal pain

Children 2-6 yrs	Abdominal pain Vomiting Fever Malodorous urine Enuresis Symptoms of dysuria, urgency, frequency
Childen older than 6 ys	Fever Vomiting Abdominal pain Back/flank pain Symptoms of dysuria, urgency, frequency Malodorous urine Incontinence

PHYSICAL EXAMINATION

- Tenderness at the costovertebral angle
- Abdominal- Suprapubic tenderness
- Palpable bladder
- Dribbling of urine, poor stream, straining to void

CLASSIFICATION & CLINICAL PRESENTATION OF UTIs

UNCOMPLICATED UTI :

It is usually considered after the episode of cystourethritis, after colonisation of the bladder and urethra by pathogens.And this form is called uncomplicated because the sequelae are rare.

COMPLICATED UTI:

These are the infections involving the parenchyma, ie pyelonephritis or prostatitits. These occur usually after instrumentation or in the presence of an obstructive uropathy, and are often refractory to treatment and result in frequent relapses. Significant sequelae such as sepsis, metastatic abscesses, renal failure can follow.

RELAPSE OF INFECTION:

It is the recurring of the infection due to the same microorganism and is often resistant to drugs. Most of the relapses occur after treatment for pyelonephritis or prostatitis.

REINFECTION:

It is the recurring of the infection of urinary tract due to a different microorganism and is usually drug susceptible. Reinfection usually occurs in cystourethritis.

Basically UTIs are classified into the following three forms :

1. Asymptomatic bacteriuria
2. Lower Urinary Tract Infection – Cystitis, prostatitis, urethritis
3. Upper Urinary Tract Infection – Pyelonephritis

ASYMPTOMATIC BACTERIURIA:

Asymptomatic bacteriuria is generally applied to patients when they are incidentally diagnosed to have bacteriuria with the classical symptoms referable to an urinary tract infection. This diagnosis is confirmed when two consecutive cultures yield the same organism in counts of 10^5 CFU or greater/ml of urine[39].

In children the incidence of asymptomatic bacteriuria is high, occurring in upto 3.7% of boys and 2.1% of girls during the first year of life. The frequency varies within the population, depending on various factors as age, sex, underlying conditions such as spinal cord injury or diabetes.

The patient characteristics also has an influence on the microbiology of asymptomatic bacteriuria. The most common pathogen is E. coli and it mostly

occurs in healthy individuals. A variety of organisms are known to cause this condition, especially Enterococcus species and gram negative bacilli especially in men. Catheterised patients usually present with polymicrobial infection.

Laboratory criteria for diagnosis of asymptomatic bacteriuria in a mid-stream clean catch urine sample are as follows[32]:

- In women, 2 consecutive specimens with isolation of atleast 10^5 colony forming units/ml of single species of bacteria.
- In men, a single specimen with isolation of about 10^5 colony forming units/ml of a single bacterial species

For diagnosis of asymptomatic bacteriuria in a catheterised urine specimen, the laboratory criterion is a single bacterial species isolated in a quantitative count of atleast 100 colony forming units/ml. This is common in both men and women.

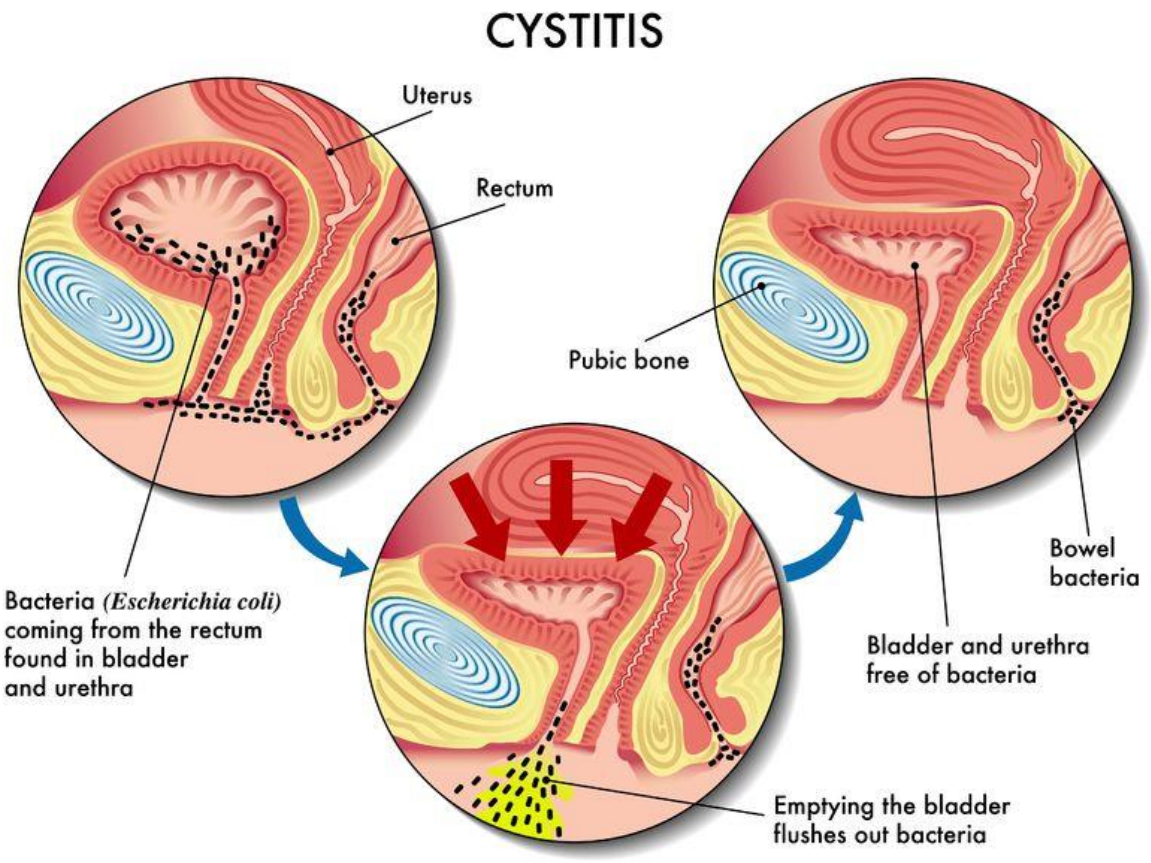
However, screening for asympytomaticbacteriuria is not advised in the general population, as treatment is not clinically beneficial as seen in certain studies. An important exception are pregnant women, in whom early screening and treatment reduces significant morbidity in them.

CYSTITIS

It is usually asymptomatic in most individuals. Sometimes it is associated with symptoms such as increased frequency, dysuria, urgency,

nocturia, urge incontinence, suprapubic pain or a sensation of incomplete emptying of the bladder. It can also be associated with an offensive smelling urine and hematuria. On examination of the patient there is suprapubic tenderness[40].

In about 30% of the patients with cystitis, the urine culture reports are usually negative. The most common causative organisms ae Chlamydia, Neisseria and Herpes simplex. In some cases the pathogens are Mycoplasma hominis or Ureaplasma urealyticum , where the patient presents with cystitis and a sterile urine culture. This condition is termed as urethal syndrome or dysuria – pyuria syndrome. Another rare condition is called Interstitial cystitis where the etiology is unknown, and the symptoms resemble that of a bacterial cystitis but with negative urine cultures.



PYELONEPHRITIS

Pyelonephritis is the term used to describe the infection of the renal parenchyma. The patients usually present with fever and chills, myalgia, nausea and vomiting, loin pain. On examination of the patient, there is severe tenderness over the renal angle[4].

Emphysematous pyelonephritis is a condition most commonly seen in diabetics where the patient presents with symptoms of acute pyelonephritis. The most common pathogen is the E. coli where 10-25% of patients present

with positive blood cultures. The examination of the urine reveals leucocyte casts and micro or macrohematuria.

Chronic pyelonephritis is diagnosed when the radiological examination shows clubbed calyces and diffuse or focal scarring of the kidneys which can be either unilateral or bilateral. The clinical course is usually insidious and the patient remains asymptomatic for a long time. They however develop hypertension and renal failure in the long run.

PROSTATITIS AND SEMINAL VESICULITIS:

The classical presentation in these patients are symptoms of frequency, dysuria, pain over the groin or perineal region, difficulty in voiding and pain during ejaculation. A per rectum examination reveals a enlarged tender prostate. One most important cause of relapsing UTI in males is chronic bacterial prostatitis. This is diagnosed by microscopical examination and culture of prostatic secretions. The patient is acutely ill with urinary symptoms and at this stage it is not advisable to do a per rectal examination.

RENAL ABSCESS:

Renal cortical abscess, also called renal carbuncle, is a condition of infection within the renal cortex which occurs secondary to hematogenous spread of Staphylococcus aureus from a primary focus elsewhere in the body. The patient presents with fever and loin pain similar to acute pyelonephritis, with no bladder symptoms. The renal cortex shows hypoechoic hypodense

areas in imaging studies. Diagnosis is by aspiration and culture under the guidance of ultrasound[15].

Perinephric infection within the perirenal space and is usually due to the rupture or extension of an intarenal abscess. The clinical course is insidious and is usually undiagnosed till a late stage. The patient presents with intermittent fever and a progressively ill health. An examination reveals a flank or abdominal mass and is treated by surgical drainage only.

VESICOURETERAL REFLUX (VUR)

VUR is defined as the flow of urine retrograde from the bladder back into ureter and renal pelvis system. Reflux occurs when normal flap valve mechanisms between the ureter and the bladder is disrupted, as when happenss when the submucous tunnel between the detrusor and the mucosa is either short or absent. It is a congenital anomaly affecting approximately 1% of children[41].

The ascent of pathogens from the urinary bladder to the upper urinary system is facilitated by reflux predisposing the individual to pyelonephritis. This inflammation may lead to reflux nephropathy, resulting in renal injury and scarring. This ultimately leads to the development of renin angiotension mediated hypertension along with renal insufficiency and renal failure.

Classification

The severity of reflux is graded into 5 types which is done regarding the appearance of the urinary system that is obtained on using the voiding cystourethrogram (VCUG)[42].

INTERNATIONAL STUDY CLASSIFICATION

Grade I : Reflux into a non-dilated ureter

Grade II : Reflux into upper collecting renal system without dilatation.

Grade III : Reflux into the dilated ureter along with blunting of Calyceal fornices

Grade IV : Reflux into the grossly dilated ureter

Grade V : Massive reflux along with significant ureteral dilatation and tortuosity and loss of all papillary impression.

The degree of severity of reflex is an indicator for the extent of abnormality involving the ureterovesical junction. The higher the grade of reflux, the greater is the likelihood of kidney injury.

Duplication of ureters are common in children and is associated with a ureterocoele, and in these patients reflux is associated with the lower pole of the ureter.Neuropathic bladder associated with myelomeningocele, sacral agenesis and reflux is present in 27% of the children at birth and.the abnormal reflux is also present in 50% of children with posterior urethral valve.

The reflux is generally diagnosed during an evaluation for a urinary tract infection and it is found that 80% of these children are females with an average age of around 2-3 years old. It is diagnosed using a voiding cystourethrogram – either a contrast enhanced VCUG or radionuclide VCUG. Other alternate methods for the diagnosis are indirect cystogaphy, or the use of ultrasonographic contrast medium. On diagnosing reflux in a patient, the extent of damage to the kidneys is assessed using ultrasonography, excretory urography (intravenous pyelogram), or renal scintigraphy performed with dimercaptosuccinic acid (DMSA).

The main goal of treatment lies in the prevention of pyelonephritis, renal injury and other complications. Treatment includes a multimodal approach including both medical and surgical options[43].

Grading	Age in years	Scarring	Treatment	Follow-up
1-2	Any age	Yes or no	Prophylactic antibiotics	Not needed
3-4	Birth to 5 yrs	Yes or no	Prophylactic antibiotics	Surgical correction
3-4	6–10	Yes/no	Unilateral : prophylactic antibiotics	Surgical correction
			Bilateral: surgery	
5	<1	Yes or no	Prophylaxis antibiotics	Surgical correction
5	1–5	No	Unilateral: antibiotic prophylaxis	Surgical Correction
5	1–5	No	Bilateral: surgical correction	
5	1–5	present	Surgeical correction	

Grading	Age in years	Scarring	Treatment	Follow-up
5	6–10	Yes/no	Surgical correction	

DIAGNOSIS OF URINARY TRACT INFECTION

The diagnosis of urinary tract infection is very essential to initiate proper antibiotic therapy based on the culture and sensitivity pattern of a properly collected clean specimen of urine. Unless proper antibiotic is not administered it would not be able to alleviate the symptoms of UTI. Urine analysis helps in providing immediate information and is an important screening test to suspect urinary tract infection and helps initiation of treatment.

URINE ANALYSIS

It is an initial screening test for urinary tract infection. urine analysis if done on a clean sample can readily identify patients with a higher probability of a urinary tract infection[34]. many rapidly available screening tests for urine analysis are available . The results may be-

1) Leukocytes in urine
2) proteinuria
3) bacterial growth on gram staining method
4) leukocyte esterase test positive and positive nitrite test done by dipstick method

PYURIA

One of the most reliable method used for measuring pus cells is to measure the leucocyte excretion in urine. Urine with an excretion rate of 4,00,000 leukocytes / hours or more correlates highly with symptomatic urinary tract infection[44].

The presence of >5 pus cells/ HPF in a centrifuged sample of fresh urine or >10 pus cells / HPF in an uncentrifuged urinary sample is suggestive of urinary tract infection.

Pyuria can also be measured by using a rapid assay to determine the presence of leukocyte esterase in the urine. Leukocyte esterase, an enzyme which is primary present in neutrophil granules.It reacts with reagent which is impregnated in the dipstick and hence producing a blue colour at room temperature within 2 minute indicative of pyuria.

BACTERIURIA

Direct microscopy used for the detection of baceteriuria is a readily available test but highly variable method of determining bacteria. Jenkinet al[45] determined that uncentrifuged gram-stained urine that revealed atleast one organism per oil immersion field correlated with $\geq 10^5$ CFU / ml urine with sensitivity and specificity of almost 90%. Additionally the finding of five or more organisms per oil immersion field increased the specificity to about 98%. Kunin had suggested the use of unstained, centrifuged clean urine as a convenient,easyand reliable method of determining significant bacteriuria in a

urine sample, but this method was most reliable only when 10^6 CFU / ml or more were isolated by urine culture.

Another rapid diagnostic test for the detection of bacteriuria, the nitrite test, is both a widely available and easily performed test. The test is performed using the dipstick method, which utilizes an amine which is impregnated to a pad to detect the presence of urinary nitrate. Nitrite in the urine is produced by the action of bacteria on dietary nitrate through nitrate reductase, a bacterial enzyme, the presence of urinary nitrite in urine is indicated by the development of a pink colour on the pad within 60 seconds.

False negative assays may be due to the result of

1. absence of dietary nitrate
2. Insufficient level of urinary nitrate due to diuretics.
3. Infection caused by an organism that is unable to produce nitrate in the urine due to lack of nitrate reductase.

Example. : Staphylococcus species

Enterococcus Species

Pseudomonas Species

Sensitivity and specificity of tests to diagnose urinary tract infection[46]

	Chemical used	Sensitivity	Specificity
A)	Nitrite	25-90%	90 - 95%
B)	Leukocyte esterase	50-80%	80%
	Microscopic		
A)	Urinalysis (Pyuria)	30-80%	30-80%
B)	Gram stain (Bacteriuria)	90%	90%
	Microbiologic		
A)	Clean catch method	80-99%	80%
B)	Catheterization method	91-95%	80-90%
C)	Suprapubic aspiration	>95%	>98%

URINE CULTURE

The detection of significant numbers of pathogenic bacteria from culture of the urine has remained the gold standard for the diagnosis of urinary tract infection since Kass defined $>10^5$ CFU /ml of a single pathogenic bacterium isolated from urine culture as being significant.It is an confirmatory test for UTI and also helps to identify the causative organism.

The urine collected for culture must always be collected carefully in order to prevent the contamination with periurethral flora growth. Washing the genitalia with soap and water before collection minimizes the risk of contamination[47]. The urine specimen for culture can be obtained in the following methods-

A) Suprapubic aspiration

B) Urethral catheterization

C) Clean midstream catch urine

D) Bag collection technique

Suprapubic aspiration has been considered the "gold standard" for obtaining urine as it is least likely to be contaminated.It is an invasive procedure and hence is rarely used nowadays.

Urine obtained by transurethral bladder catheterization is next accurate method if done correctly but at times may be traumatic.

A clean midstream urine is routinely used for collection.

Urine bag collection method is an easy non-invasive procedure but takes a longer time and chances of contamination are high.

Plating of the urinary sample must be done within 1 hour of collection. The specimen collected is then inoculated onto blood agar media and MacConkey media and then incubated for 24 hours to obtain an accurate colony count.

Urine Culture reports interpretation[48] :

	Collection technique	**Colony counts**	**Probability of growth (%)**
1.	Suprapubic aspirate	any Count	98.9
2.	Catheterization technique	$\geq$ 10 ^3 CFU / ml	95.5
3.	Midstream urine	$>10^5$ CFU / ml	90

IMAGING STUDIES

The goal of imaging studies in patients with a urinary infection is to identify abnormalities early that predispose to infection.

ULTRASONOGRAM –KUB

It is a non-invasive and inexpensive method and does not cause radiation exposure[49].

a. A renal ultrasonogram should be obtained to rule out anatomical abnormalities like cystic kidneys, hydronephrosis and renal or perirenal abscesses;
b. Identifies acute pyelonephritis by demonstrating an enlarged kidney.
c. Ultrasonography demonstrates 30% of renal scars,
d. Urinary tract obstruction like PUV.
e. Disorders in ureters like ureteroceles,duplication and dilatation.
f. Disorders in bladder like vesicoceles and hypertrophy.
g. Renal ultrasonography is also used for diagnosing pyonephrosis, a condition that may require prompt drainage of the collecting system by percutaneous nephrostomy.

Negative results have a good predictive valve and do require further follow up in low probability cases.abnormal results require further evaluation.

The main disadvantage associated with ultrasonogram is that it is insensitive in detecting vesicourethralreflux.

VOIDING CYSTOURETHEROGRAM-

It is gold standard method for detection posterior urethral valve and vesicourethral reflex. It is an invasive procedure,expensive and causes radiation exposure[50].

A voiding cystourethrogram (VCUG) is indicated in all children younger than 5 years of age with a urinary tract infection,in any child with a febrile urinary tract infection, school going girls who have had more than 2 episodes of urinary tract infections, and in any male child with a urinary tract infection. The most common finding is vesicoureteral reflux, which is found in about 45% of patients.

It is usually done 3- 4 days after the child starts responding to therapy. A newer modality is now available called nuclear version that causes less radiation exposure but has a lower resolution and this procedure requires an iv access.

DMSA SCAN

It is a gold standard method for detection of renal scars. When the diagnosis of acute pyelonephritis is uncertain, renal scan with technetium 99 labelled Dimercaptosuccinic acid scan (DMSA) or glucoheptonate is very helpful. The presence of parenchymal filling defect on the DMSA scan may support the diagnosis of pyelonephritis but may not differentiate an acute from a chronic process.

DMSA scan may show a filling defect in approximately 50% of

children with a febrile urinary tract infection, irrespective of age of the child. In children with grade III, IV or Vesicoureteral reflux, 90% of patients with a febrile urinary tract infection have a focal defect[51].

Technetium 99m dimercaptosuccinic acid is administered through iv route.it is uptaken into proximal tubular cells and can be visualised on imaging 2 hours later.

Radiation to bones and ovaries through this method is also minimal through this method. Computed tomography is another diagnostic tool that can diagnose acute pyelonephritis.

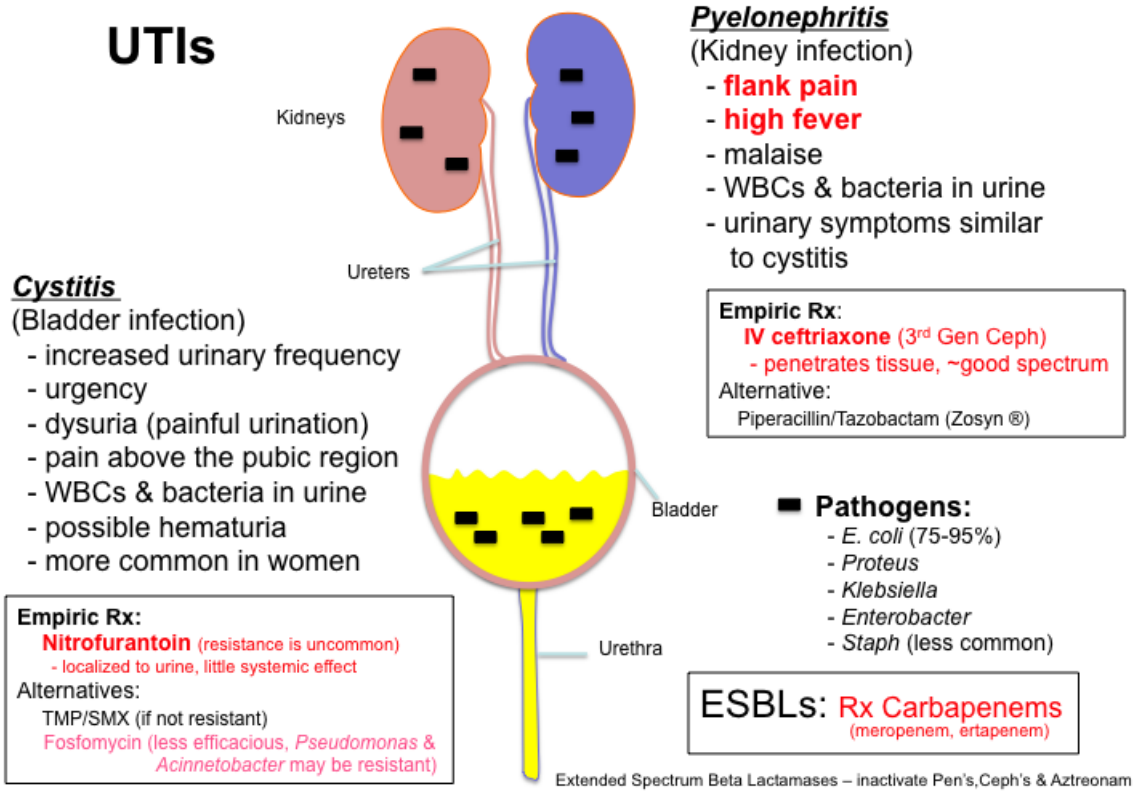
MANAGEMENT

Ideally treatment should be started after sending a urine culture and sensitivity sample. Empirical treatment with antibiotics is started while awaiting the culture reports. The child's age, sex, symptomatology, toxicity, hydration status and the compliance with medications are useful in determing between outpatient therapy and inpatient hospitalisation.

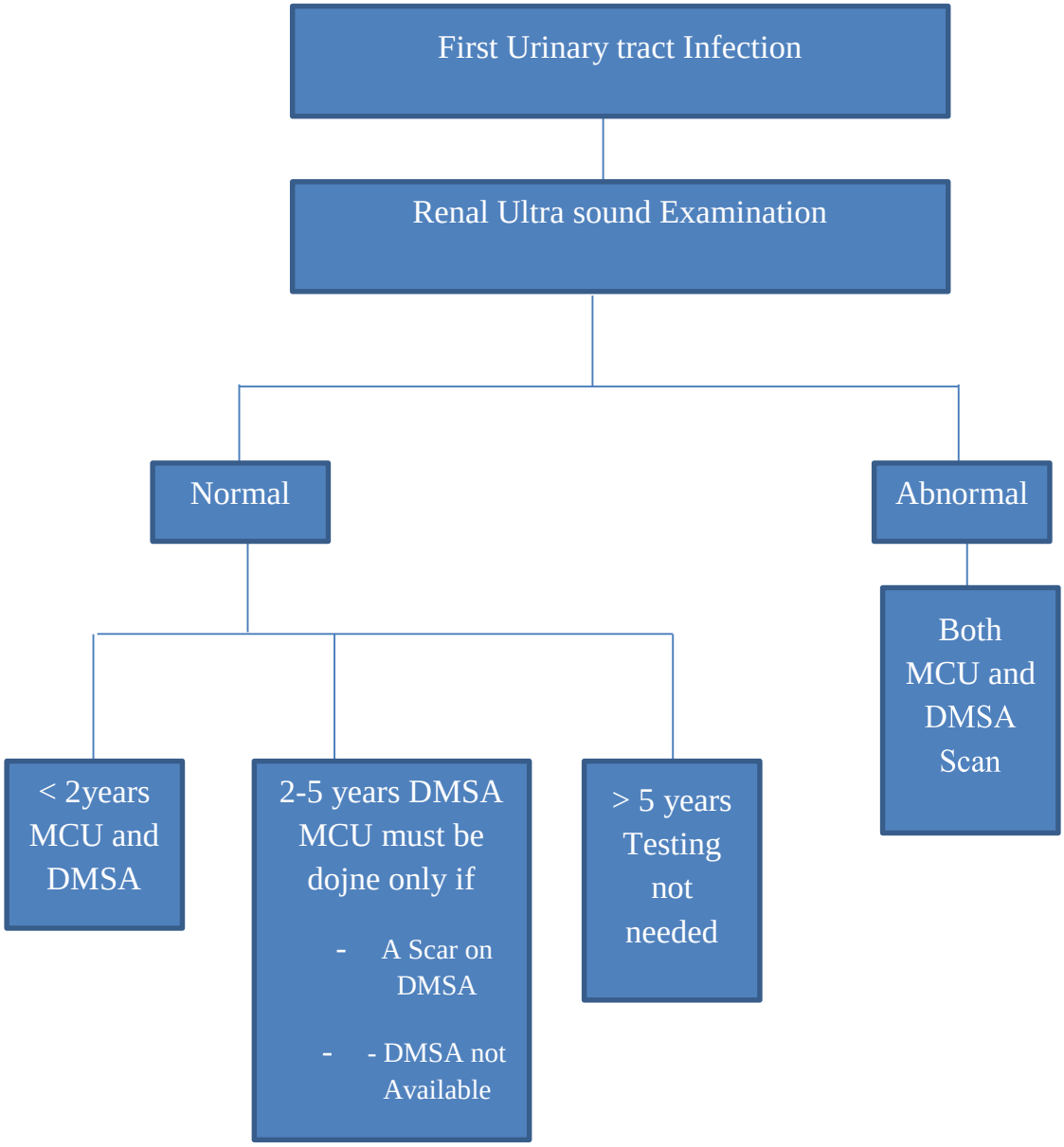
Patients with complicated urinary tract infection and children less than 2 months of age should be treated with IV antibiotics. A combination with Ampicillin (100 mg / kg / day) and Gentamicin (5 mg / kg / day) or a third generation cephalosporin is usually preferred. After the child starts showing clinical improvement, with subsidence of fever and toxicity, oral antibiotics are then prescribed. Young infants and children with blood culture reports as positive should receive IV anibiotics during the entire period of treatment.

Oral medications should be used in children above 2 months of age with a simple urinary tract infection. Amoxycillin, Cotrimoxazole or an oral cephalosporin is the preferred oral antibiotic of choice. Quinolone antibiotics must not be used as the first line medication of choice. The total duration of therapy for patients with complicated urinary tract infection is 10 to 14 days and 7-10 days for uncomplicated infection[52].

The initial antibiotic of choice is usually given based on the idea of regional resistance patterns. Cefixime is the most common initial antibiotic used for the first episode of UTI and while awaiting susceptibility results.



The imaging in urinary infection is adviced for all patients with a urinary tract infection. Children having more than one episode of urinary tract infection should be screened with renal ultrasound and MCU.



INDICATIONS OF ANTIBIOTIC PROPHYLAXIS[53]

1. Following treatment of

   a) The first episode of urinary tract infection in children under the age of 2 yrs.

   b) A complicated urinary tract infection in all kids below 5 years of age, while awaiting for imaging studies.

2. All Children having Vesicouretheric reflux

3. All Children having renal scars after urinary tract infection even

if reflux is not demonstrated. Prophylaxis must be stopped if the radionuclide scan repeated after 6 months is within normal limits.

4. All Children with frequent febrile urinary tract infection even if the urinary tract is normal.

MATERIAL AND METHODS

Our present study was conducted in the Department of Paediatrics Tirunelveli Medical College, during the period of 01/06/2014 to 01/06/2015.

SELECTION OF PATIENTS

Febrile children less than 5years attending the out patient department or admitted in the hospital over a period of 12 months were included in our study.

INCLUSION CRITERIA

1. Febrile children from 2 month to 5years.
2. Fever (auxiliary temperature ≥37.8°C)

EXCLUSION CRITERIA

1. Children below 2 months and above 5 years.
2. Any child who has received antibiotics 48 hours prior were not be included in the study.
3. Children with known congenital genitourinary anomalies.

METHODS OF STUDY

200 children who were considered in our study. And all information regarding their age, sex, socioeconomic class and various predisposing factors like instrumentation of the urethra, voiding difficulties were collected. A complete history related to the onset, duration of fever and associated symptoms such as nausea, vomiting, diarrhea, urinary disturbances, other

system involvement was obtained.

A complete physical examination with significant investigations were carried out in all children. The blood investigations and urine analysis along with urine culture and sensitivity were done in all these children. USG examination were done, in culture positive cases, in 2 cases MCU was done and then the detailed data was entered in the proforma.

COLLECTION OF URINE SAMPLE

Urine samples were collected from all the 200 children. In children under 2 years of age urine was collected by a bag collection method and in children above 2 yrs clean midstream sample was collected.

A) BAG COLLECTION METHOD-

children less than 2 years the genitalia was cleaned with soap and water and the person collecting the sample must wash hands before touching the bag or bottle for collecting urine sample. In male children prepuce is retracted if possible, in female children below 2years the labia is split apart and washed. Urine was collected in bag, around 10 ml of urine was transferred into sterile bottle and sent for culture and sensitivity .In children above 2 years of age midstream sample was collected.

B) MID STREAM URINE SAMPLE

After the above precautions are taken the child was allowed to pass urine and then mid-stream urine sample was collected in sterile bottle and then

sent for culture and sensitivity.

METHOD OF URINE ANALYSIS

The urine samples obtained from the above techniques were then subjected for urinalysis and urine culture and sensitivity. The urine specimens were then centrifuged in a chamber, 10ml of urine was span at the rate of 2500 rpm for about 30 minutes,and the supernatant fluid was then decanted off and the remaining sediment was resuspended in the chamber.The urine was then examined under miscroscope for Hematuria, and Leukocyturia.In our study more than 5 pus cells /HPF in a centrifuged sample of urine was considered as significant pyuria and culture and sensitivity was performed in that child.

METHOD OF URINE CULTURE

The clean mid-stream catch urine was inoculated into blood and mac conkey agar plates using a 0.01millilitre caliberated loop. All plates were then incubated at 35-37^{0}C for about 24 hours under aerobic condition in order to obtain accurate colony count. On culture of the mid-stream sample of urine, a colony count of more than 10^5 /ml organisms of a single species of bacteria were considered to be significant.

Samples with insignificant growth, mixed growth of two or more pathogens or growth of non-pathogens were not considered to be culture positive.

POSITIVE URINE CULTURE

A positive urine culture was defined as growth of $>10^5$ colonies of a single urinary tract pathogen/ml of specimen in a clean mid-stream of urine.

RESULTS AND OBSERVATIONS

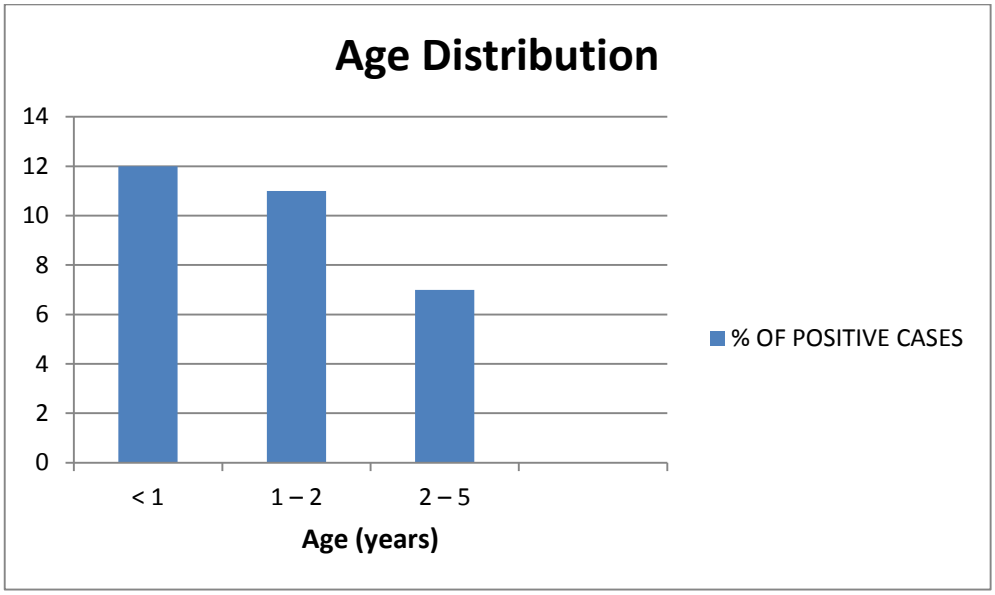
During the 12 month study period, a total number of 200 patients were studied between the age group of 2 months to 5 years, to determine the prevalence of urinary tract infection in all febrile patients. It also assessed the validity of investigations in diagnosing urinary tract infections.

AGE DISTRIBUTION:

Table 1: Age Distribution among the Study Population

AGE GROUP (IN YEARS)	NUMBER	%
< 1	69	35
1 – 2	47	23
2 – 5	84	42

Chart No 1 - Age Distribution among the population



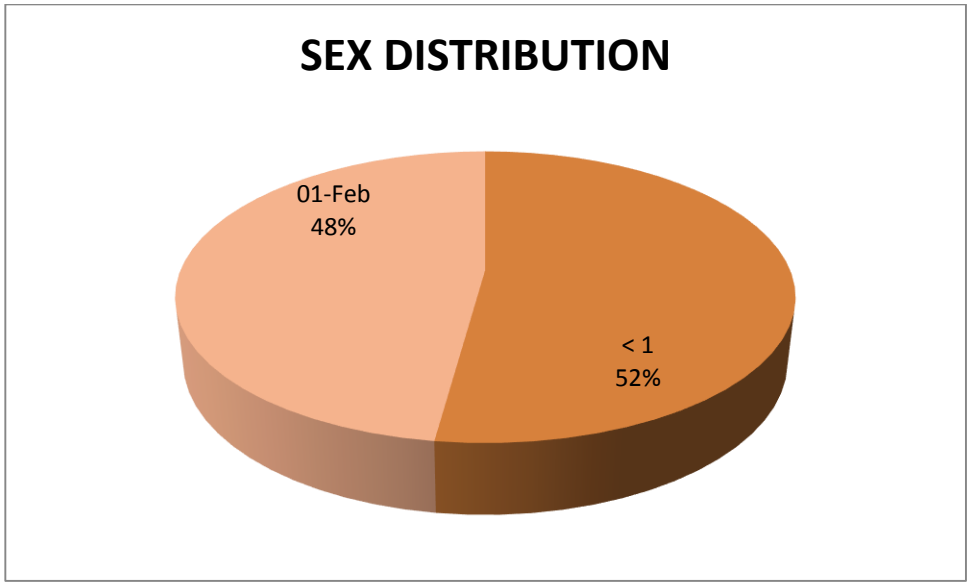
The study population had 200 subjects in the age group of 2 months-5years. The mean age group of the total population was 2 years 6 months. Among the 200 children included in our study majority of the children were in the age group of 2-5 years (42%).

Sex Distribution:

Table No 2 – Sex Distribution among the study population

Sex	Number	%
Males	95	47.5
Females	105	52.5
Total	200	100

Chart No 2 – Sex Distribution among the study population

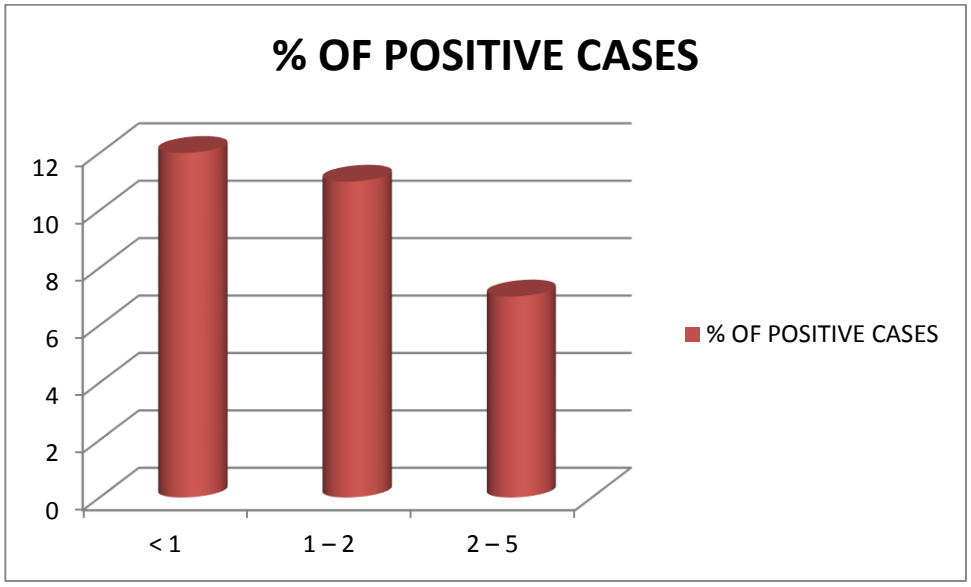


Among the 200 patients, 95 were males (47%) and 105 were females (53%). The ratio of male: female was 0.9:1.

Table no:3 Age Wise Distribution Among UTI Cases

	Growth in Culture		% of Positive Cases
Age (in years)	Yes	No	
<1	8	61	12
1 - 2	5	42	11
2 - 5	6	78	7

Chart no :3 Age Wise Distribution Among UTI Cases

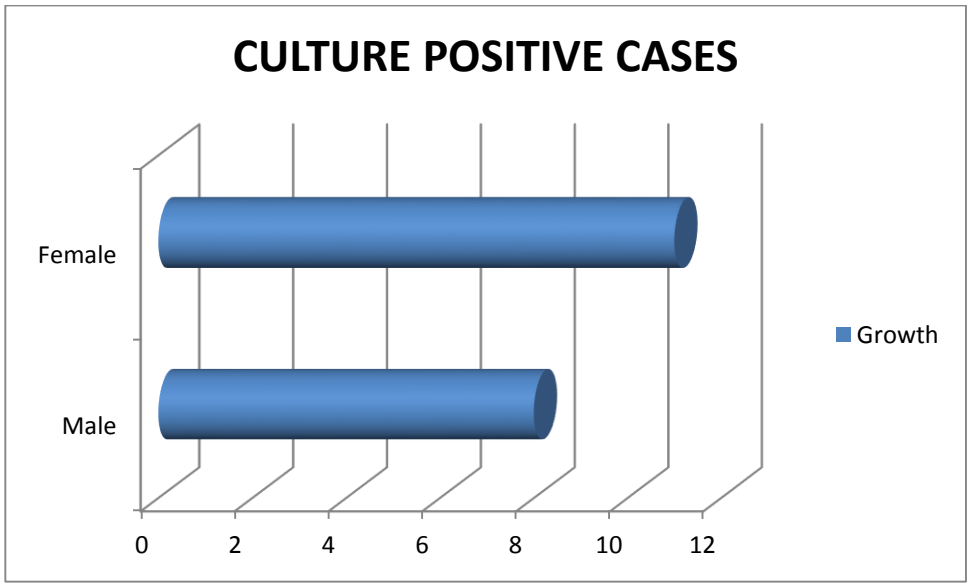


The incidence of UTI is more common among the <1 year age group. The incidence in < 1 yr was highest (12%), 1-2 yrs had an incidence of 11 % and >2 yrs the incidence was 7 % .

TABLE-4 : GENDER WISE DISTRIBUTION AMONG UTI CASES

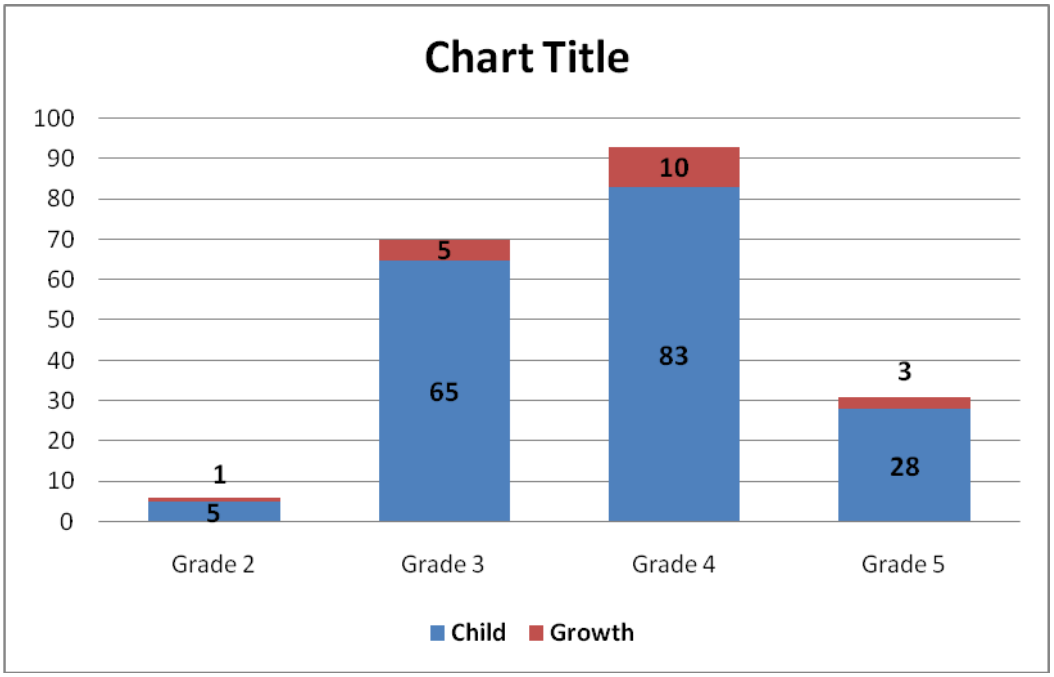
Gender	Child	Growth	%
Male	95	8	8
Female	105	11	10

CHART 4 : GENDER WISE DISTRIBUTION AMONG UTI CASES



Among the 200 cases, the prevalence of UTI was higher among females (10%) than males(8%).

TABLE 5- DISTRIBUTION AMONG SOCIOECONOMIC STATUS:

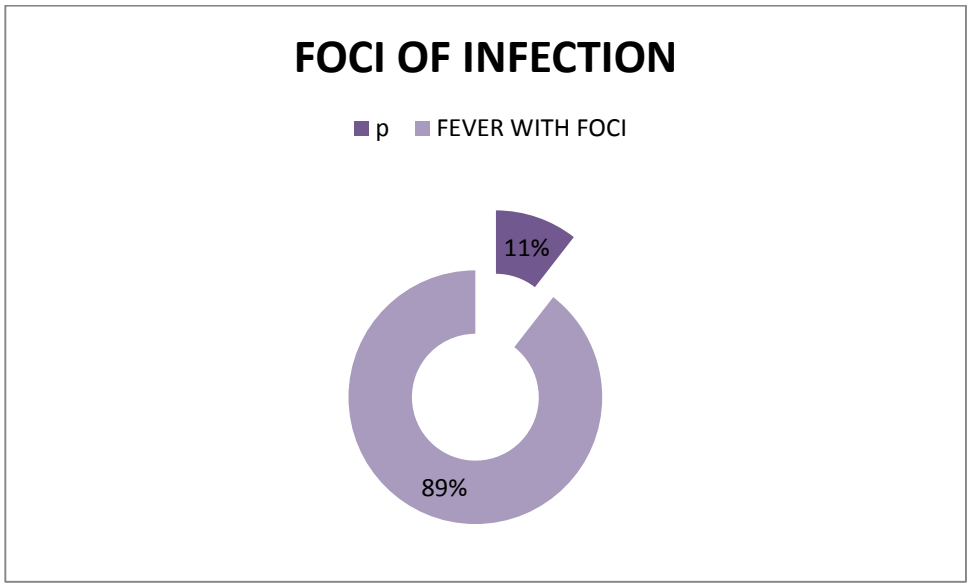


Majority of them were within the low socioeconomic status (64%), the rest belonged to the middle socioeconomic status.

TABLE-6 : FOCI OF INFECTION AMONG UTI CASES

FEVER WITHOUT FOCI	2
FEVER WITH FOCI	17
TOTAL	19

CHART 6 : FOCI OF INFECTION AMONG UTI CASES

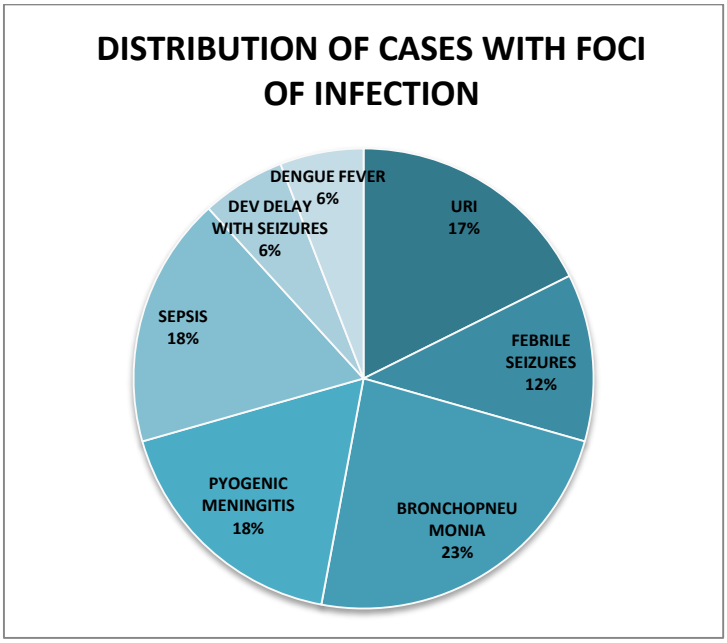


Among the culture positive cases UTI, an underlying foci of infection was present in 89% of cases and only 11% of cases did not have any foci.

TABLE 7- DISTRIBUTION OF UTI CASES WITH FOCI OF INFECTION

FOCI OF INFECTION	NO OF CASES		P value
	Culture positive	No growth	
URI	3	13	0.834
FEBRILE SEIZURES	2	20	
BRONCHOPNEUMONIA	4	17	
PYOGENIC MENINGITIS	3	30	
SEPSIS	3	33	
DEV DELAY WITH SEIZURES	1	11	
DENGUE FEVER	1	7	

FIGURE 7- DISTRIBUTION OF CASES WITH DEFINITE FOCI OF INFECTION

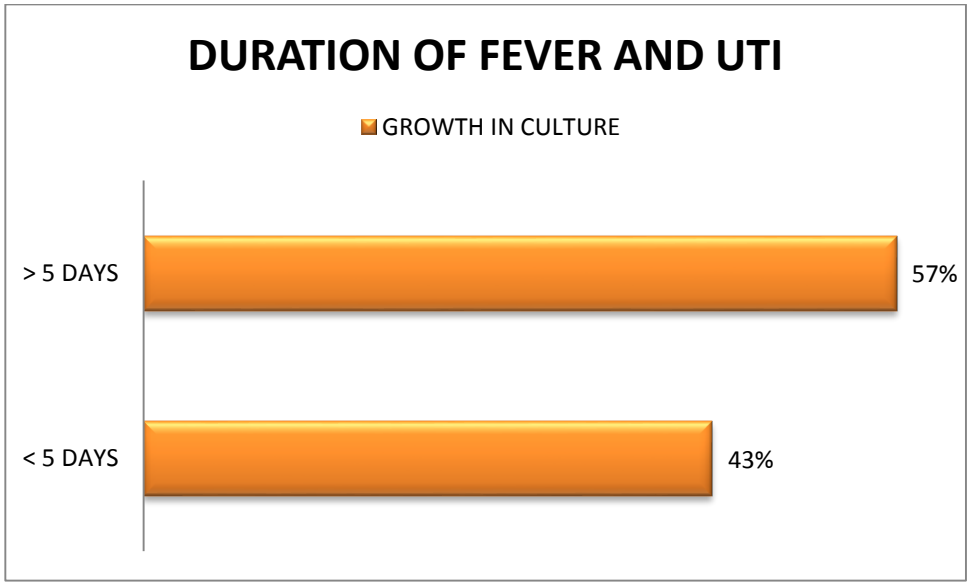


Among the foci of infection, bronchopneumonia accounted for majority of the cases of UTI followed by sepsis and pyogenic meningitis.

TABLE 8 :ASSOCIATION BETWEEN DURATION OF FEVER AND UTI

DURATION OF FEVER	NO OF CASES	
	GROWTH	NO GROWTH
< 5 DAYS	8	79
➢ 5 DAYS	11	102

FIGURE 8 : ASSOCIATION BETWEEN DURATION OF FEVER AND UTI

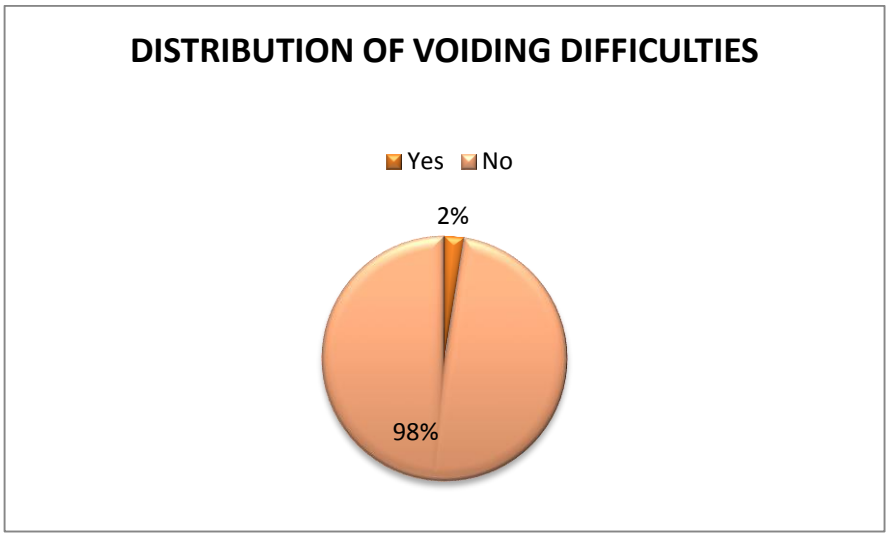


In our study, the % of cases with duration of fever more than 5 days was 57, as compared to 43% in patients with fever less than 5 days.

TABLE 9- DISTRIBUTION OF CHILDREN WHO PRESENTED WITH VOIDING DIFFICULTIES

Voiding difficulties	No of cases
Yes	5
No	195

FIGURE 9- PERCENTAGE DISTRIBUTION OF CASES WITH VOIDING DIFFICULTIES



Among the patients, 5 of them presented with voiding difficulties, which constituted about 2% of the study population.

TABLE-10

ASSOCIATION BETWEEN VOIDING DIFFICULTIES AND UTI CASES

	Growth in Culture		
Voiding Difficulties	Yes	No	p value < 0.0001
Yes	5	0	
No	14	181	

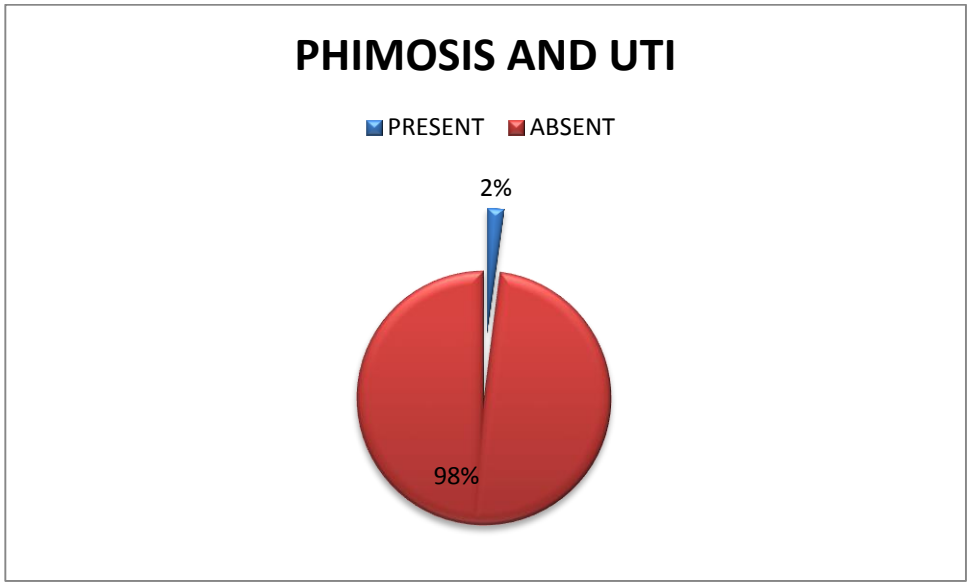
Among the 19 UTI cases 5 of them presented with voiding difficulties and all the 5 cases had significant growth on culture.

There was significant association between the UTI cases and voiding difficulties.

Table 11 : ASSOCIATION BETWEEN PHIMOSIS AND UTI

PHIMOSIS	NO OF CASES	%
PRESENT	3	2
ABSENT	197	98

FIGURE 11: ASSOCIATION BETWEEN PHIMOSIS AND UTI

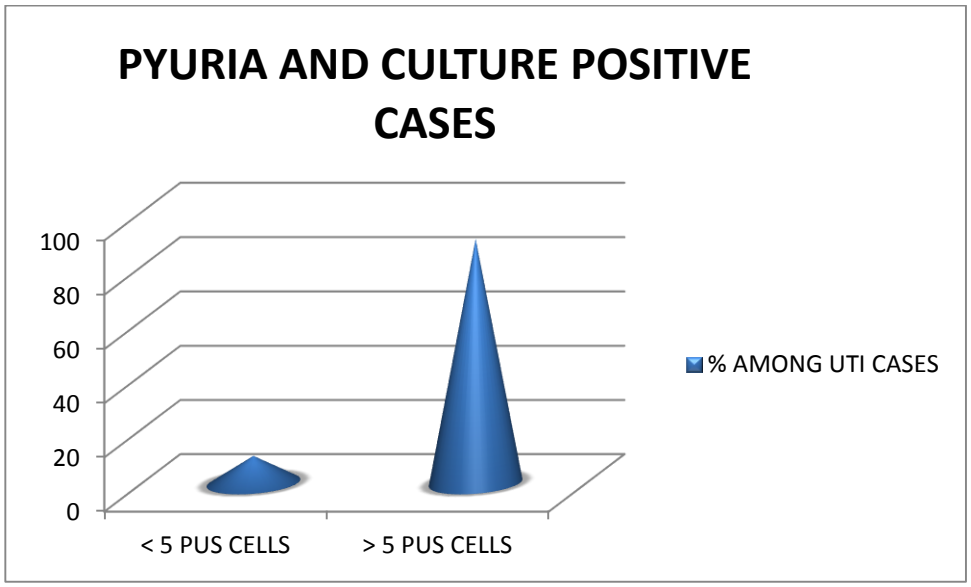


Among the 200 cases 3 cases of phimosis were present and all of them showed significant growth in culture.

TABLE 12- ASSOCIATION OF PYURIA AND CULTURE POSITIVE UTI CASES

	GROWTH		
PYURIA	YES	NO	p value < 0.001
< 5 PUS CELLS	2	23	
>5 PUS CELLS	17	-	

FIGURE 12: ASSOCIATION OF PYURIA AND CULTURE POSITIVE UTI CASES

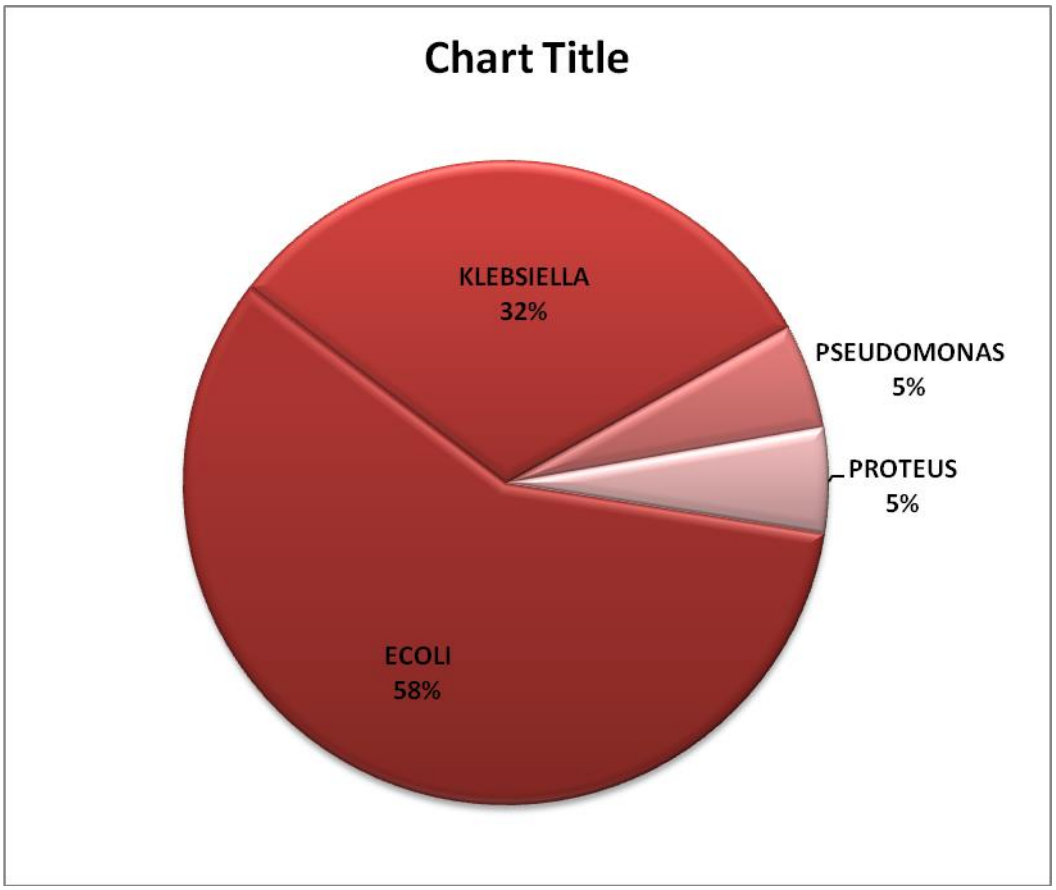


Among the 19 culture positive UTI cases 17 cases showed significant pyuria. There was a strong association between significant pyuria cases and culture growth.

TABLE 13- URINE CULTURE GROWTH PATTERNS AMONG THE UTI CASES

CULTURE GROWTH	NO OF CASES		
	MALE	FEMALE	TOTAL
ECOLI	5	6	11
KLEBSIELLA	2	4	6
PSEUDOMONAS	0	1	1
PROTEUS	1	0	1

FIGURE 13 - PERCENTAGE DISTRIBUTION OF ORGANISMS GROWN ON CULTURE



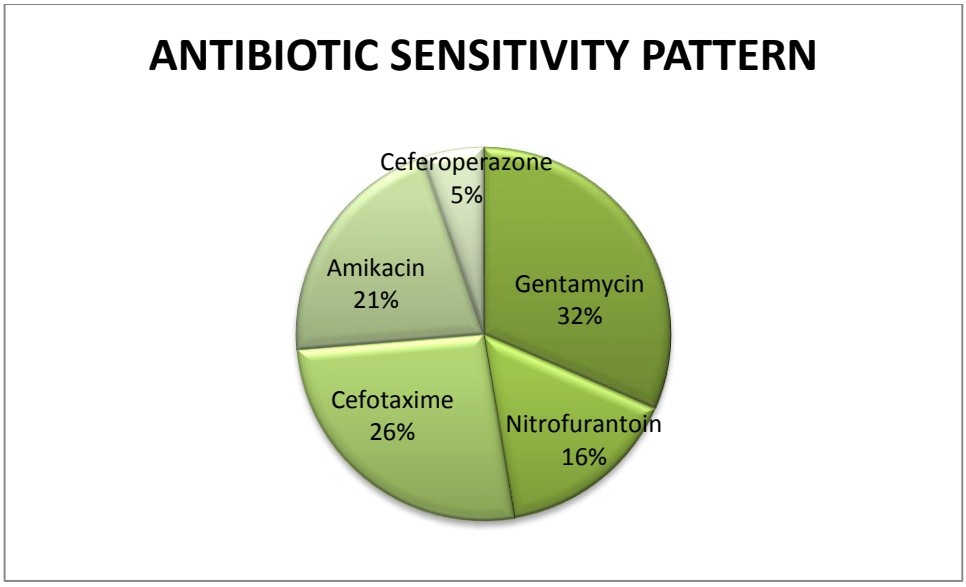
According to this study, the most common organism isolated in the culture was E. coli which constituted 58%, followed by Klebsiella which was 32% followed by Pseudomonas and Proteus, both of which constituted 5%.

TABLE 14- SENSITIVITY PATTERN OF THE ORGANISMS GROWN ON CULTURE

SENSITIVITY	NO OF CASES
Gentamycin	6
Nitrofurantoin	3
Cefotaxime	5
Amikacin	4
Ceferoperazone	1

FIGURE 14- DIAGRAM SHOWING SENSITIVITY PATTERN

SENSITIVITY	NO OF CASES
Gentamycin	6
Nitrofurantoin	3
Cefotaxime	5
Amikacin	4
Ceferoperazone	1



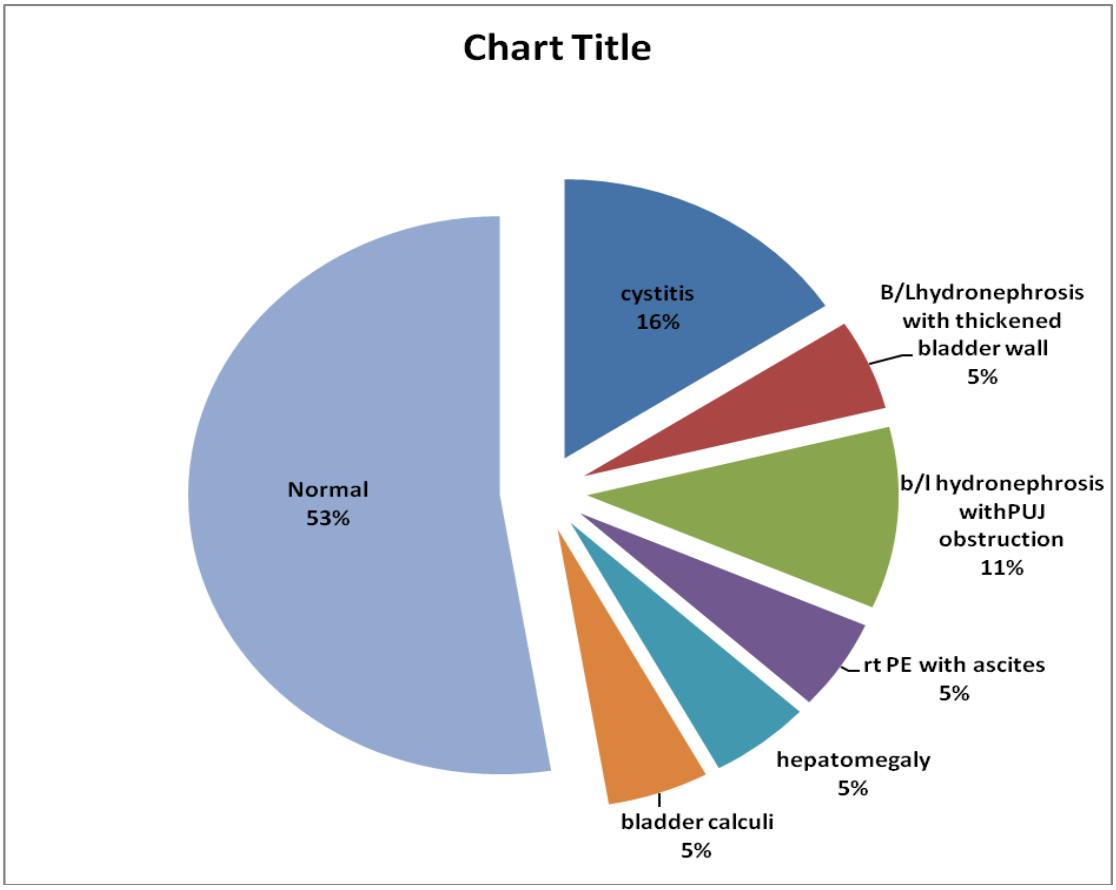
Among the organisms grown most of them had shown antibiotic sensitivity to gentamycin followed by cefotaxime.

TABLE 15- USG FINDINGS IN ALL THE UTI CASES

USG	MALE	FEMALE
CYSTITIS	1	2
B/L HYDRONEPHROSIS WITH THICKENED BLADDER WALL	1	-
B/L HYDRONEPHROSIS WITH PUJ OBSTRUCTION	2	-
BLADDER CALCULI	-	1
HEPATOMEGALY	-	1
RT PE WITH ASCITES	-	1
NORMAL	4	6

USG was done in all the 19 UTI cases,among them 10 were normal and among the remaining 9 cases 7 showed significant abnormality invoving the renal system.

FIGURE 15- CHART SHOWING ULTRASONOGRAM FINDINGS IN UTI PATIENTS



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Among the UTI cases 16% showed features of cystitis in USG followed by 11% showed b/l hydronephrosis with PUJ obstruction.

DISCUSSION

Urinary tract infections are one of the most common and serious infections found in children. They are also a serious cause of morbidity and lead to permanent sequelae which includes diseases like hypertension and renal failure. An early

Diagnosis of urinary tract infection is very essential as it aids us in the appropriate treatment of the acute illness and also it also helps us to ensure the correct evaluation and follow up of the child. Ruling out an urinary tract infection is of utmost importance to avoid the unnecessary economic burden of the patients and also to avoid any advert or potentially harmful evaluation and treatment of the child.

our present study was a prospective study conducted in Department of Paediatrics, Tirunelveli Medical College over a period of 1 year between June 2014 to June 2015 to determine the prevalence of infection of the urinary tract infection in all children with fever between 2 months to 5 years of age and also to assess the validity of investigations such as routine urine analysis and culture of the urine in the diagnosis of urinary tract infection.

A total of 200 febrile children were included in the study.In our study out of the 200 patients 95 were males and 195 were females with M: F ratio 0.9:1 and majority of them were within the age group of less than 1 year (4%).

TABLE: PREVALENCE OF UTI IN FEBRILE CHILDREN

SL NO	STUDY	PREVALENCE
1.	PRESENT STUDY	9.5%
2.	R K Kausal et al	8.4%
3.	DharniDharaka et al	5.4%
4.	Hoberman et al	5.3%

In our study out of 200 children, 26% of children showed significant pyuria. Among these pyuric children bacterial growth was found in only 45% of cases making an overall prevalence of 9.5%.Among culture positive UTI'S 68% were <2years of age with an overall prevalence rate of 6.5% in children <2years and 4% in children <1year.

The Prevalence of febrile UTI in infants in our present study was almost similar to study by DharniDharaka et al[12] (1993) who reported a prevalence of 5.4% in febrile infants, Hoberman et al[11](1993)who reported prevalence of 5.3% in infants.

The Overall prevalence of Urinary tract infection in all febrile children in our study was 9.5% and 4% in children <5years and infants respectively which is in contrast to study conducted by (R.K.Kaushal et al[41]2003)who reported higher prevalence of UTI among infants. 8.4% and 12.3% in children <5years and infants respectively.

TABLE: PREVALENCE OF UTI IN INFANTS

SL NO	STUDY	PREVALENCE
1.	PRESENT STUDY	4%
2.	Shaw K N et al	3.3%
3.	R K Kausal et al	3.5%

Overall prevalence of febrile UTI in infants in our study(4%)was higher compared to report by (Shaw K.N et al[1]1998)from USA who reported prevalence of 3.3% in febrile infants.

TABLE: PREVALENCE OF UTI IN AGE GROUP 1-2 YRS

SL NO	STUDY	PREVALENCE
1.	PRESENT STUDY	6.5%
2.	Roberts K et al	4.1%
3.	Srivasths et al	2.4%

In our study prevalence of UTI in children <2years age group was 6.5% which was similar to the study conducted by Roberts k.et al[9](1983)which had a prevalence rate of 4.1%.P.R Srivasths et al[13](1996) had reported a prevalence of 2.48% in children<2years which was the lowest reported prevalence from a developing country.

TABLE: PREVALENCE OF E.COLI INFECTION

SL NO	STUDY	PREVALENCE
1.	PRESENT STUDY	58%
2.	Bryan C S et al	85%
3.	Aravind Bagga et al	90%

Among culture positive cases 58%grew E.coli followed by klebseilla 32% and 5%each of pseudomonas, proteus species, which correlates well with other studies. Bryan C.S et al[19](1984) reported E.coli as the most common urinary pathogen in 85%of cases. According to Aravind Bagga et al[20](2000)90% of the first symptomatic urinary tract infection and 70% of reccurant infections were due to E.coli. Hoberman et al[11](1993)reported as E.coli as the most common bacteria isolated in his study.

Also through our study various risk factors like phimosis, voiding difficulties and prolonged duration of fever were found to be highly significant.

There was no significant association between the socioeconomic status as the cases were unevenly distributed.

Also there was no association between the foci of fever and UTI and hence UTI may occur in children with any underlying foci of infection

As per hospital norms abdominal ultrasound were done only in children who showed significant growth in culture which revealed positive results in 7

cases. And among them, 2 cases which revealed hydronephrosis were subjected to MCU.

Through our study we had diagnosed 2 cases of grade 1 and grade 4 VUR and prophylactic antibiotics was started in grade 1 VUR and grade 4 VUR was subjected to surgery.

In our study only 10% of children who showed <5 pus cells were culture positive and all the children who showed >5 pus cells were culture positive. Hence the presence of pyuria of >5leukocytes/HPF in a centrifuged sample is a significant indicator of UTI.

Hence all medical personnels must be aware that the possibility of febrile children may have urinary tract infection and should consider obtaining a urine culture specimen as part of their diagnostic evaluation.

Also the presence of any another potential source of fever such as meningitis, upper respiratory tract infection,bronchopneumonia,otitis media is not reliable in excluding urinary tract infection.

Several studies conducted in developed countries have shown a low prevalence rate (1.7 – 4.1%) of urinary tract infection in febrile children[9, 10] .

CONCLUSION-

Our present study reveals similar results of overall prevalence rate of UTI (9.5%) in febrile children 2 month to 5 years.

And the prevalence rate in children <1 year of age was highest (4%).

.All the children with pyuria of > 5 pus cells/ HPF of centrifuged urine sample were found to have significant growth and hence the association between pyuria >5 pus cells and urine culture is highly significant and hence this test is highly valid.

Hence through our study we concluded that pyuria of > 5 pus cells /HPF in centrifuged sample should be considered as significant pyuria and hence further evaluation should be done in all these cases to promptly initiate antibiotic treatment and also to prevent morbidity and several long term sequelae.

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PROFORMA

NAME :

CASE STUDY NO :

AGE :

UTI NO :

SEX :

DATE :

ADDRESS :

OP/IP NO :

SOCIO – ECONOMIC STATUS:

HISTORY OF PRESENT COMPLAINT:

Fever (Rectal >/38.3 C (or) Axillary temp >/ 37.8 C)

H/O fever more than 3 days (definite source / no definite source)

H/O taking antibiotics – YES/NO

ASSOCIATED COMPLAINTS:

Infants and young children:

Diarrhoea/vomiting/abdominal pain/poor weight gain.

Older children:

Urgency /burning /frequency /flank pain /colour /foul smelling /bed wetting.

Presence of any risk factors:

Female /uncircumcised male /toilet training /dribbling

/complete emptying YES/NO

Urethral instrumentation /perineal hygiene /pin worm infestation.

Constipation /anatomic abnormality.

Bowel and bladder hygiene: good/poor

Past history:

H/O similar complaint in the past.

H/O tuberculosis, diabetes, hypertension.

Family history:

Birth history

Developmental history: normal/delayed

Immunization status: UN immunized/partially immunized/completely immunized.

General Examination:

Pallor /jaundice /cyanosis /clubbing /pedal oedema.

Generalised lymphadenopathy.

Vital data

Temperature : F

Respiratory Rate : /min

Pulse Rate : /min

BP : mm hg

Anthropometry :

Weight	Kgs	Percentile
Height	Cms	Percentile
HC	cms	Percentile
MAC	Cms	Percentile

Systemic Examination:

Abdominal Examination:

Inspection of Genitalia: Normal /phimosis /meatal stenosis /fused labia

Respiratory System :

CVS :

CNS :

Investigations :

Urine Analysis – Mid steam sample of urine/Bag Sample

Microscopy - Urine Culture and sensitivity (lab no.Date :)

Treatment Given:

Follow up :

SL.NO	NAME	AGE IN YEARS	SEX	IP.NO	SES	FEVER WITH OTHER FOCUS	DURATION OF FEVER	VOIDING DIFFICULTIES	H/O CIRCUMCISION	PHIMOSIS	URINE DEPOSITS	URINE ALBUMIN	URINE SUGAR	HEMOGLOBIN	TOTAL WBC COUNT	URINE C/S	BL SUGAR	BL UREA	SR CREATININE	USG ABDOMEN	VCUG
1	mareeswari	1	fch	12678	3	Pneumonia	4	no	no	no	nil	nil	nil	11.6	5200	no growth	88	21	0.6	-	
2	karuppasamy	1.00	mch	13088	4	no	6	no	no	no	nil	nil	nil	12.5	6100	no growth	78	24	0.9	-	
3	ram susanth	2	mch	13398	4	URI	5	no	no	no	4-6 pus	+	nil	9.5	4900	ecoli growth	89	26	0.6	-	
4	harsan	2	mch	13458	4	meningitis	6	no	no	no	nil	nil	nil	12.5	5600	no growth	90	31	0.7	-	
5	ajith kumar	0.91	mch	13487	3	febrile seizures	8	no	no	no	nil	nil	nil	9.5	8700	no growth	87	37	0.4	-	
6	nasren	0.83	mch	13530	4	sepsis	9	no	yes	no	nil	nil	nil	9.8	9500	no growth	92	26	0.7	-	
7	kanaga	2	fch	13755	4	dev delay	6	no	no	no	nil	nil	nil	11.5	11200	no growth	95	28	0.3	-	
8	aarthi	0.58	fch	144028	2	Pneumonia	4	no	no	no	1- 2 pus	nil	nil	12	8600	no growth	104	39	0.7	-	
9	gopikrishna	2	mch	13918	3	sepsis	7	no	no	no	nil	nil	nil	10	4800	no growth	146	26	0.6	-	
10	kumaran	0.75	mch	13910	4	sepsis	5	no	no	no	nil	nil	nil	9.6	11700	no growth	127	29	0.9	-	
11	maheshbala	1.75	mch	14169	4	no	3	no	no	no	nil	nil	nil	10.5	5200	no growth	87	25	0.6	-	
12	priya	2	fch	14438	2	no	10	yes	no	no	4-6 pus	nil	nil	11.3	9600	ecoli growth	89	31	0.5	cystitis	
13	sona	5	fch	14437	3	Dengue fever	2	no	no	no	nil	nil	nil	12.7	4500	no growth	95	34	0.9	-	
14	prabhakaran	1.58	mch	14515	4	febrile seizures	5	no	no	no	4-6pus	+	nil	9.8	4500	ecoli growth	108	27	0.6	B/Lhydronephrosis with thickened bladder wall	
15	sivakumar	4	mch	14556	5	febrile seizures	6	no	no	no	nil	nil	nil	10.4	5900	no growth	116	28	0.5	-	
16	vatchala	1.75	mch	14711	4	sepsis	9	no	no	no	nil	nil	nil	11.2	6300	no growth	129	25	0.4	-	
17	amala	4	fch	14735	4	no	7	no	no	no	nil	nil	nil	10.8	5900	no growth	84	26	0.3	-	
18	thangavijay	0.5	mch	14770	3	Bronchopneumonia	7	yes	no	yes	8-10 pus	nil	nil	9.7	11200	klebsiella growth	76	64	2.2	b/l hydronephrosis withPUJ obstruction	grade 4
19	mahelvan	3	mch	14908	3	Bronchopneumonia	3	no	no	no	nil	nil	nil	10.6	10600	no growth	98	38	0.6	-	
20	ponkaviya	1.5	fch	14929	3	sepsis	6	no	no	no	nil	nil	nil	11.6	4500	no growth	94	26	0.9	-	
21	nishan	4	mch	14942	4	dev delay	8	no	yes	no	nil	nil	nil	12.3	8500	no growth	139	39	0.4	-	
22	rakesh	2	mch	15115	3	no	9	no	no	no	-2 pus	nil	nil	12.7	7900	no growth	125	29	0.6	-	
23	yakash	0.83	mch	15181	4	sepsis	7	no	no	no	nil	nil	nil	9.9	9500	no growth	116	34	0.5	-	
24	kanaga	4	fch	15238	4	no	5	no	no	no	nil	nil	nil	10.3	6800	no growth	78	31	0.4	-	
25	anisha	3	fch	15510	3	febrile seizures	4	no	no	no	nil	nil	nil	11.2	6800	no growth	89	27	0.8	-	
26	rajeshkumar	3	mch	15529	5	meningitis	5	no	no	no	nil	nil	nil	11.7	7300	no growth	94	25	0.5	-	
27	anantharaj	1	mch	16140	4	URI	6	no	no	no	nil	nil	nil	12.6	8200	no growth	145	22	0.7	-	
28	charu	3	fch	16046	3	URI	8	no	no	no	6-8 pus	nil	nil	10	9100	klebsiella growth	105	27	0.9	-	
29	mukesh	0.75	mch	16279	4	meningitis	9	no	no	no	10-12 pus	trace	nil	12.4	4900	klebsiella growth	117	28	0.5	-	
30	pennile	5	fch	16360	5	Dengue fever	7	no	no	no	nil	nil	nil	12.9	8600	no growth	97	26	0.7	-	
31	santhiya	5	fch	16612	4	dev delay	5	no	no	no	2-4 pus	nil	nil	11.7	7500	no growth	78	29	0.6	-	
32	abisha	2	fch	16489	3	febrile seizures	3	no	no	no	nil	nil	nil	10.2	11800	no growth	79	37	0.8	-	
33	johnson	5	mch	16477	4	no	6	no	no	no	nil	nil	nil	11.3	10400	no growth	80	34	0.5	-	
34	maharajan	5	mch	16859	3	no	4	no	no	no	nil	nil	nil	12.6	5900	no growth	100	31	0.7	-	
35	nagarajan	5	mch	17129	4	no	7	yes	no	yes	4-6 pus	++	nil	10.5	6800	ecoli growth	124	39	0.8	cystitis	
36	perumal	1.5	mch	17346	4	Bronchopneumonia	8	no	no	no	nil	nil	nil	12.4	9100	no growth	136	25	0.3	-	
37	yash	1.25	mch	17641	4	meningitis	9	no	no	no	nil	nil	nil	9.9	9300	no growth	108	23	0.5	-	
38	esakkiselva	3	mch	17941	3	no	10	no	no	no	nil	nil	nil	10.8	8900	no growth	138	22	0.4	-	
39	senthil kumaran	5	mch	18018	3	URI	4	no	no	no	nil	nil	nil	11.7	7500	no growth	98	26	0.7	-	
40	prajan rajan	3	mch	18038	5	meningitis	5	yes	no	no	4-6 pus	nil	nil	12.1	8600	proteus growth	95	28	0.6	-	
41	sankarvel	5	mch	18077	4	no	6	no	no	no	nil	nil	nil	13	4900	no growth	93	34	0.8	-	
42	suhasan	3	mch	18239	4	no	8	no	no	no	nil	nil	nil	9.2	5800	no growth	76	31	0.9	-	
43	mugesh	4	mch	18252	4	febrile seizures	9	no	no	no	nil	nil	nil	10.3	6100	no growth	99	37	0.5	-	
44	esakithai	4.5	fch	18409	5	Dengue fever	5	no	no	no	nil	nil	nil	9.5	7300	no growth	87	23	0.4	-	
45	panithee	2.5	fch	18570	5	meningitis	6	no	no	no	nil	nil	nil	11.6	9400	no growth	70	31	0.8	-	
46	moh.flasook	1	mch	18610	3	no	8	no	yes	no	nil	nil	nil	13	12200	no growth	149	26	0.8	-	
47	dharsini	5	fch	18794	4	no	9	no	no	no	nil	nil	nil	9.6	7800	no growth	139	41	0.9	-	
48	abinaya	2	fch	18973	4	no	5	no	no	no	8-10 pus	+	nil	10.5	9300	ecoli growth	136	28	0.5	cystitis	
49	vanniya	4.5	mch	18982	5	no	2	no	no	no	2-4 pus	nil	nil	9	9800	no growth	141	39	0.6	-	
50	kavin	2	mch	19152	3	no	3	no	no	no	nil	nil	nil	12.5	6800	no growth	129	24	0.5	-	

51	ramsusheath	3	mch	19182	4	febrile seizures	4	no	no	no	nil	nil	nil	12.7	9400	no growth	93	22	0.8	-	
52	krishnapriya	3	fch	20043	4	Dengue fever	7	no	no	no	4-6 pus	nil	nil	11	6800	klebsiella growth	83	21	0.6	rt PE with ascites	
53	ramya	2	fch	19633	3	no	8	no	no	no	nil	nil	nil	12.5	9100	no growth	85	29	0.5	-	
54	merlin	2	fch	19711	4	no	9	no	no	no	nil	nil	nil	10.9	8300	no growth	75	30	0.8	-	
55	janani	5	fch	20442	4	dev delay	6	no	no	no	nil	nil	nil	11.4	7600	no growth	93	22	0.6	-	
56	antonybasu	0.91	mch	20613	3	sepsis	5	yes	no	yes	10-12 pus	nil	nil	9.6	8800	ecoli growth	97	25	0.5	-	
57	logeshram	3	mch	20869	4	no	5	no	no	no	nil	nil	nil	12.7	9400	no growth	114	27	0.8	-	
58	munishrani	2	fch	21035	5	no	3	no	no	no	nil	nil	nil	11.9	5800	no growth	95	22	0.6	-	
59	esakimuthu	1	mch	21050	3	meningitis	4	no	no	no	nil	nil	nil	12.5	4600	no growth	115	23	0.5	-	
60	marimuthu	3	mch	21072	3	no	6	no	no	no	nil	nil	nil	9.9	5600	no growth	107	27	0.4	-	
61	viniselvam	3	mch	21108	4	no	8	no	no	no	nil	nil	nil	10.6	6700	no growth	87	38	0.8	-	
62	madhuja	3.5	fch	21201	5	febrile seizures	9	no	no	no	nil	nil	nil	11	9800	no growth	98	34	0.7	-	
63	kamakshi	4	fch	21412	3	Dengue fever	7	no	no	no	1-2 pus	nil	nil	12.1	8700	no growth	93	31	0.6	-	
64	manikandan	0.58	mch	21470	5	URI	5	no	no	no	4-6 pus	nil	nil	9.1	9100	ecoli growth	106	45	1.8	b/l hydronephrosis withPUJ obstruction	grade 1
65	nishanth	4	mch	21781	5	no	2	no	no	no	nil	nil	nil	12.5	8500	no growth	117	26	0.8	-	
66	karthiprassana	1.5	mch	21841	4	Bronchopneumonia	10	no	no	no	nil	nil	nil	13	5600	no growth	127	28	0.4	-	
67	ansi	1.5	fch	21876	5	Bronchopneumonia	8	no	no	no	nil	nil	nil	9	7600	no growth	141	23	0.7	-	
68	madhavan	4	mch	22039	5	no	9	no	no	no	nil	nil	nil	10.9	4900	no growth	128	24	0.5	-	
69	asmika	3	fch	27201	3	no	6	no	no	no	nil	nil	nil	12.9	8900	no growth	130	25	0.4	-	
70	esakimuthu	2	mch	22309	3	febrile seizures	5	no	no	no	nil	nil	nil	11.5	5600	no growth	104	32	0.8	-	
71	ranjani	2.75	fch	23061	4	sepsis	4	no	no	no	2-4 pus	nil	nil	10.6	8800	ecoli growth	127	31	0.6	hepatomegaly	
72	balamurugan	5	mch	23250	4	no	7	no	no	no	nil	nil	nil	9.8	10100	no growth	99	29	0.5	-	
73	praneena	4	fch	23559	3	dev delay	3	no	no	no	nil	nil	nil	10.5	7800	no growth	142	25	0.9	-	
74	maheshwari	0.58	fch	23564	4	Bronchopneumonia	8	no	no	no	2-4 pus	+	nil	13	9800	klebsiella growth	139	23	0.5	-	
75	sivaselvi	2	fch	23598	4	no	9	no	no	no	nil	nil	nil	10.6	7100	no growth	135	26	0.7	-	
76	praveen	0.33	mch	24622	4	meningitis	4	no	no	no	nil	nil	nil	11	4700	no growth	120	32	0.6	-	
77	subbulakshmi	3	fch	25480	5	no	7	no	no	no	nil	nil	nil	10.8	3790	no growth	68	40	0.4	-	
78	esakiammal	4	fch	25900	3	no	4	no	no	no	-2 pus	nil	nil	11.4	7400	no growth	79	34	1.1	-	
79	santhosh	4	mch	26450	4	febrile seizures	9	no	no	no	nil	nil	nil	12.4	8600	no growth	113	25	0.7	-	
80	esakkiselva	0.41	fch	26780	3	meningitis	3	no	no	no	nil	nil	nil	11	5760	no growth	78	32	0.8	-	
81	amrita	3	fch	26870	3	no	6	no	no	no	nil	nil	nil	11.8	4700	no growth	85	20	0.6	-	
82	arun	5	mch	25780	4	no	8	no	no	no	nil	nil	nil	10.6	5500	no growth	94	24	0.6	-	
83	sairam	5	mch	25800	4	no	3	no	no	no	nil	nil	nil	10.8	5840	no growth	104	30	0.9	-	
84	roger	0.5	mch	27599	5	meningitis	9	no	no	no	nil	nil	nil	9.8	11600	no growth	76	22	1	-	
85	venkatesh	0.75	mch	26945	4	meningitis	3	no	no	no	nil	nil	nil	11.5	9800	no growth	118	27	0.8	-	
86	nivitha	2	fch	24764	5	sepsis	11	no	no	no	nil	nil	nil	12	6780	no growth	86	34	0.5	-	
87	vikram	4	mch	27469	3	Dengue fever	2	no	no	no	nil	nil	nil	13.2	9780	no growth	88	28	0.3	-	
88	diana	3	fch	25498	4	URI	6	no	no	no	1 -2 pus	nil	nil	10.7	10300	no growth	110	39	0.5	-	
89	fathima	3	fch	26190	3	febrile seizures	7	no	no	no	nil	nil	nil	11.8	11000	no growth	98	27	0.2	-	
90	ajay kumar	4	mch	26789	4	no	8	no	no	no	2-4 pus	nil	nil	11.5	5780	no growth	86	29	0.5	-	
91	kumaran	3	mch	26816	5	dev delay	4	no	no	no	nil	nil	nil	8.9	7800	no growth	74	37	0.4	-	
92	priya	0.33	fch	27893	4	meningitis	9	no	no	no	nil	nil	nil	10	8900	no growth	99	35	0.7	-	
93	sankari	3	fch	27463	2	febrile seizures	4	no	no	no	nil	nil	nil	9.6	4500	no growth	115	22	0.8	-	
94	nithya	0.58	fch	27569	3	meningitis	7	no	no	no	-2 pus	nil	nil	11.4	6550	no growth	134	28	0.3	-	
95	suresh	0.83	mch	26954	4	Bronchopneumonia	5	no	no	no	nil	nil	nil	12.1	5800	no growth	132	19	0.5	-	
96	ganesan	3	mch	28400	3	no	9	no	no	no	nil	nil	nil	10.8	7600	no growth	84	15	0.9	-	
97	anburajan	5	mch	25615	5	no	4	no	no	no	nil	nil	nil	10.4	6990	no growth	94	34	1	-	
98	shreesai	3	mch	27846	3	URI	3	no	no	no	nil	nil	nil	9.9	10400	no growth	86	28	1.1	-	
99	lakshmanan	4	mch	27024	4	no	8	no	no	no	nil	nil	nil	12.2	5800	no growth	119	30	0.6	-	
100	jerin	2	fch	25655	5	sepsis	4	no	no	no	2-4 pus	nil	nil	11.8	4690	no growth	134	18	0.7	-	

101	karishma	2	fch	28037	4	sepsis	7	no	no	no	nil	nil	nil	9.5	7800	no growth	115	32	0.8	-	
102	mahesh	1.58	mch	28180	5	meningitis	4	no	no	no	nil	nil	nil	10	7900	no growth	132	26	0.9	-	
103	akash	3	mch	28221	3	sepsis	5	no	no	no	nil	nil	nil	11	4590	no growth	89	29	0.6	-	
104	esakiammal	0.58	fch	28303	4	dysentry	3	no	no	no	nil	nil	nil	9.8	8890	no growth	95	40	0.7	-	
105	vanasankari	5	fch	28450	4	seizures	8	no	no	no	nil	nil	nil	9	9800	no growth	78	21	0.8	-	
106	prison samuel	0.16	mch	28450	3	meningitis	5	no	no	no	2 -4 pus	nil	nil	11	10770	no growth	105	34	0.5	-	
107	kaushik	3	mch	28719	4	no	6	no	no	no	nil	nil	nil	11.6	8960	no growth	140	20	0.3	-	
108	murugan	1.5	mch	28720	4	ARI	4	no	no	no	nil	nil	nil	12.4	4560	no growth	132	35	0.9	-	
109	kanishka	0.66	fch	27851	4	FTT/sepsis	9	no	no	no	nil	nil	nil	9.8	9870	no growth	119	27	0.8	-	
110	sagunthala	0.25	fch	277543	4	meningitis	7	no	no	no	nil	nil	nil	10.6	9650	no growth	125	38	0.9	-	
111	parvin	0.33	fch	28741	3	Bronchopneumonia	5	no	no	no	-2 pus	nil	nil	11.6	10980	no growth	132	20	0.3	not done	
112	jeyakani	2	fch	29123	3	URI	4	no	no	no	nil	nil	nil	12.3	5670	no growth	129	36	0.4	not done	
113	maheswari	0.75	fch	29143	3	sepsis	7	no	no	no	nil	nil	nil	9.6	9099	no growth	105	17	0.6	not done	
114	arummugathai	3	fch	29445	4	no	7	no	no	no	nil	nil	nil	10	4820	no growth	122	25	0.8	not done	
115	mahadevi	0.41	fch	29765	5	meningitis	4	no	no	no	1-2 pus	nil	nil	10.5	7650	no growth	86	19	0.5		
116	nallamal	2	fch	29777	3	sepsis	5	no	no	no	nil	nil	nil	10.5	8750	no growth	99	24	0.9		
117	abinaya	4	fch	29876	4	dev delay	8	no	no	no	nil	nil	nil	11.19	9810	no growth	110	32	0.3		
118	sathish	1.25	mch	29874	3	URI	6	no	no	no	nil	nil	nil	12.1	6120	no growth	146	26	0.7		
119	yasodha	0.66	fch	29876	3	sepsis	5	no	no	no	nil	nil	nil	11.8	8790	no growth	83	30	0.4		
120	esakiammal	3	fch	29987	4	no	7	no	no	no	nil	nil	nil	9.5	7650	no growth	93	36	0.7		
121	pavithra	2.16	fch	29989	4	no	9	no	no	no	nil	nil	nil	11.9	9860	no growth	78	28	0.8		
122	anupama	3	fch	29999	5	febrile seizures	4	no	no	no	nil	nil	nil	12.4	7650	no growth	97	35	0.5		
123	murugakani	0.41	mch	30021	4	Bronchopneumonia	7	no	no	no	nil	nil	nil	9.8	8750	no growth	84	27	0.9		
124	kalleswari	4	mch	30065	3	Dengue fever	3	no	no	no	nil	nil	nil	11.8	4780	no growth	115	24	0.7		
125	bhavana	3	fch	30100	3	febrile seizures	6	no	no	no	6-8 pus	nil	nil	12.1	9830	ecoli growth	128	28	0.5	bladder calculi	
126	selvi	0.75	fch	30173	4	meningitis	5	no	no	no	nil	nil	nil	11.2	9330	no growth	134	38	0.9		
127	thalima	1.41	mch	30222	5	sepsis	7	no	no	no	nil	nil	nil	10	8730	no growth	139	28	0.7		
128	nevilson	3	mch	30345	3	no	9	no	no	no	nil	nil	nil	10.5	10980	no growth	94	32	0.5		
129	george	0.41	mch	30346	4	meningitis	6	no	no	no	-2 pus	nil	nil	10.7	7680	no growth	85	37	0.8		
130	robin	0.75	mch	30376	4	Bronchopneumonia	5	no	no	no	nil	nil	nil	9.7	8890	no growth	99	28	0.1		
131	prabhakaran	3	fch	30387	2	URI	7	no	no	no	nil	nil	nil	10.8	8870	no growth	93	32	0.3		
132	maari	0.75	mch	30398	4	sepsis	4	no	no	no	nil	nil	nil	11.2	5670	no growth	104	30	0.4		
133	manimala	1.5	fch	30410	5	sepsis	6	no	no	no	nil	nil	nil	12.1	5890	no growth	116	24	0.6		
134	premraju	3	mch	30444	3	no	5	no	no	no	nil	nil	nil	10	10780	no growth	78	18	0.8		
135	amutha	0.58	fch	30456	4	meningitis	7	no	no	no	nil	nil	nil	9	8970	no growth	85	15	0.6		
136	maheswari1y4m	0.66	mch	30487	3	meningitis	4	no	no	no	nil	nil	nil	10.3	7680	no growth	124	29	0.9		
137	isa safreen	0.75	mch	30499	3	sepsis	3	no	yes	no	nil	nil	nil	9.9	6540	no growth	135	36	0.5		
138	mahadevi	1.58	fch	30566	4	meningitis	5	no	no	no	nil	nil	nil	10.6	56760	no growth	127	18	0.3		
139	pappamal	0.33	fch	30588	4	sepsis	6	no	no	no	nil	nil	nil	11.3	6790	no growth	152	20	0.6		
140	muthuselvi	1	fch	30599	3	meningitis	4	no	no	no	6-8 pus	+	nil	12.3	6870	ecoli growth	113	34	0.9		
141	esakkiraj	3	mch	30654	4	febrile seizures	4	no	no	no	nil	nil	nil	11.5	5690	no growth	110	27	0.9		
142	muthuselvi	0.41	fch	30666	5	sepsis	8	no	no	no	nil	nil	nil	12.3	5780	no growth	88	40	1		
143	shivanikha8m	0.66	fch	30678	5	meningitis	6	no	no	no	2-4 pus	nil	nil	11.6	4600	no growth	114	34	0.5		
144	indhumathi	2	fch	30688	3	URI	5	no	no	no	nil	nil	nil	10.2	6500	no growth	124	18	0		
145	valli	3	fch	30698	4	febrile seizures	4	no	no	no	nil	nil	nil	11	9650	no growth	163	22	0.7		
146	satheesh	3	mch	30700	4	dev delay	5	no	no	no	nil	nil	nil	10	10900	no growth	98	26	0.4		
147	deivanai	0.66	fch	30713	3	sepsis	6	no	no	no	nil	nil	nil	12.4	10010	no growth	85	35	0.9		
148	esaiselvi	1.16	fch	30724	4	sepsis	4	no	no	no	nil	nil	nil	12	7640	no growth	77	42	0.3		
149	muthumari	2	fch	30872	4	URI	7	no	no	no	nil	nil	nil	11.4	4580	no growth	116	38	0.2		
150	rajibunisha	2	fch	30888	4	febrile seizures	7	no	no	no	nil	nil	nil	10.3	8790	no growth	143	30	0.6		

151	tamil arasu	0.25	mch	30897	3	Bronchopneumonia	8	no	no	no	-2 pus	nil	nil	9.6	4340	no growth	134	19	0.9		
152	kanaga	5	fch	30923	3	no	6	no	no	no	nil	nil	nil	11.7	5730	no growth	140	27	0.7		
153	durgadevi	0.5	fch	30987	4	Bronchopneumonia	6	no	no	no	4-6 pus	+	nil	10.8	4320	pseudomonas	136	38	0.5		
154	tamilselvan	2.25	mch	30999	3	meningitis	12	no	no	no	nil	nil	nil	10.7	6570	no growth	118	26	0.4		
155	selvakumar	1.5	mch	31567	2	sepsis	2	no	no	no	nil	nil	nil	12.3	8790	no growth	139	33	0.8		
156	balachandar	0.33	mch	31578	4	sepsis	5	no	no	no	nil	nil	nil	12	6570	no growth	117	19	0.1		
157	isaikumar	0.75	mch	31456	5	meningitis	7	no	no	no	nil	nil	nil	10	5670	no growth	132	26	0.5		
158	bharanedharane	4	mch	31555	4	febrile seizures	9	no	no	no	-2 pus	nil	nil	12.1	7650	no growth	140	30	0.4		
159	mariammal	3	fch	31888	3	dev delay	7	no	no	no	nil	nil	nil	9.7	4650	no growth	111	27	0.5		
160	vijaya lakshmi	1	fch	31678	4	no	5	no	no	no	nil	nil	nil	10.2	9860	no growth	93	28	0.6		
161	usha	0.66	fch	31479	3	sepsis	8	no	no	no	nil	nil	nil	11	5670	no growth	80	33	0.9		
162	jancy	1	fch	31898	3	URI	4	no	no	no	nil	nil	nil	9.6	9870	no growth	99	29	0.3		
163	ilaiveni	0.5	fch	32456	4	Bronchopneumonia	6	no	no	no	nil	nil	nil	9.8	6470	no growth	135	17	0.7		
164	subhridha	0.91	fch	32654	4	meningitis	8	no	no	no	nil	nil	nil	12.5	7860	no growth	142	25	0.5		
165	monika	2	fch	32479	5	no	9	no	no	no	6- 8 pus	nil	nil	10.7	10980	ecoli growth	75	34	0.7		
166	ajaykumaranumasankari	3	mch	32654	3	febrile seizures	8	no	no	no	nil	nil	nil	9.7	4320	no growth	94	28	0.8		
167	anushgadevi	3.25	fch	32786	4	no	4	no	no	no	nil	nil	nil	11	7810	no growth	79	19	1.1		
168	poomari	4	fch	32469	3	Dengue fever	6	no	no	no	nil	nil	nil	11.6	4900	no growth	105	22	0.6		
169	mathana	0.33	mch	32897	3	meningitis	3	no	no	no	nil	nil	nil	10.3	5670	no growth	113	37	0.7		
170	anandhi	0.41	mch	32987	4	sepsis	7	no	no	no	nil	nil	nil	12.1	9070	no growth	160	33	0.8		
171	thangamari	0.75	mch	33456	3	meningitis	5	no	no	no	nil	nil	nil	12.2	5680	no growth	130	27	0.4		
172	kokila	1	fch	33678	4	sepsis	8	no	no	no	2-4 pus	nil	nil	10.7	10960	no growth	114	30	0.7		
173	ramesh	2	mch	33954	3	febrile seizures	5	no	no	no	2-4 pus	nil	nil	11.4	11000	no growth	143	28	0.1		
174	chitra	3	fch	34567	4	dev delay	4	no	no	no	nil	nil	nil	11.6	6780	no growth	117	35	0.4		
175	marianthony	3	mch	34954	5	no	6	no	no	no	nil	nil	nil	10	8790	no growth	87	39	0.6		
176	rajalaksmi	0.41	fch	34679	3	meningitis	4	no	no	no	nil	nil	nil	11.6	5670	no growth	94	18	0.4		
177	aiswarya	4	fch	35689	4	no	8	no	no	no	nil	nil	nil	10.7	5430	no growth	118	23	0.8		
178	muthuselvi	1.5	fch	35474	4	meningitis	7	no	no	no	nil	nil	nil	11.3	9600	no growth	97	27	0.6		
179	anadhavalli	2	fch	35123	4	sepsis	6	no	no	no	nil	nil	nil	12.1	4530	no growth	103	36	0.6		
180	parameshwari	0.58	fch	35698	3	Bronchopneumonia	5	no	no	no	nil	nil	nil	10.4	7110	no growth	127	30	0.3		
181	jerin	4.5	fch	35663	5	no	4	no	no	no	nil	nil	nil	11.3	4500	no growth	152	24	0.4		
182	mohammed irfan	2	mch	35987	3	febrile seizures	9	no	yes	no	nil	nil	nil	10.4	5410	no growth	110	35	0.6		
183	mariaanthony	0.5	mch	35999	4	sepsis	11	no	no	no	nil	nil	nil	11.6	8970	no growth	92	29	0.7		
184	muthumari	0.58	mch	36567	4	Bronchopneumonia	4	no	no	no	nil	nil	nil	11	7860	no growth	88	32	0.5		
185	chitra	2	fch	36567	2	URI	7	no	no	no	nil	nil	nil	12.1	8760	no growth	116	36	0.4		
186	rajalakshmi	1.5	fch	36785	3	sepsis	4	no	no	no	nil	nil	nil	9.6	6540	no growth	140	28	0.7		
187	ishwarya	1.33	fch	36987	4	sepsis	6	no	no	no	nil	nil	nil	9.6	7850	no growth	133	34	0.5		
188	parameshwari	0.41	fch	37658	4	Bronchopneumonia	8	no	no	no	-2 pus	nil	nil	10.2	10670	no growth	117	40	0.7		
189	soniya	0.58	fch	37865	4	Bronchopneumonia	4	no	no	no	nil	nil	nil	9.7	10980	no growth	142	37	0.4		
190	kishore	1.66	mch	37898	3	URI	7	no	no	no	nil	nil	nil	9	9870	no growth	118	21	1.1		
191	suresh	0.91	mch	37658	4	sepsis	5	no	no	no	nil	nil	nil	10.4	7650	no growth	107	17	0.4		
192	kalaiselvi	0.83	fch	37894	3	no	8	no	no	no	nil	nil	nil	11.3	676840	no growth	112	33	0.9		
193	nagarani	1	fch	37999	3	URI	4	no	no	no	nil	nil	nil	12.1	9870	no growth	132	39	0.7		
194	pavithra	0.33	fch	38678	4	sepsis	6	no	no	no	4-6 pus	nil	nil	10	5670	klebsiella growth	95	18	0.8		
195	jothilaksmi	0.25	fch	39087	3	meningitis	7	no	no	no	nil	nil	nil	9.6	9800	no growth	139	26	0.3		
196	sumathi	0.41	fch	37654	4	sepsis	7	no	no	no	nil	nil	nil	10.1	6760	no growth	127	22	0.9		
197	saroja devi	3	fch	37688	4	dev delay	5	no	no	no	nil	nil	nil	10.9	6700	no growth	120	25	0.7		
198	joyson	4	mch	37567	3	febrile seizures	8	no	no	no	2-4 pus	nil	nil	12	5690	no growth	114	28	0.5		
199	rajini	0.5	fch	37777	5	Bronchopneumonia	4	no	no	no	nil	nil	nil	11.1	5550	no growth	109	34	0.5		
200	priya	3	fch	37893	3	meningitis	5	no	no	no	nil	nil	nil	10.8	6700	no growth	138	22	0.7		